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MEDICAL JURISPRUDENCE.

LONDON
PRINTED BY SPOTTISWOODE AND CO.
NEW-STREET SQUARE

THE

PRINCIPLES AND PRACTICE

OF

MEDICAL JURISPRUDENCE.

BY

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PREFACE.

The Manual of Medical Jurisprudence has been for twenty years before the Profession, during which time it has passed through seven large editions. The increase of matter with each successive edition has at length rendered it necessary to revise the plan of the work, and the present volume is the result of this revision. In addition to the subjects which have been hitherto treated in the Manual, others have been introduced, so as to give a more complete and extended view of the Principles and Practice of Medical Jurisprudence.

Among the new subjects which find a place in this volume are :—The Signs and Phenomena of Death, with an account of the Changes which take place in the Dead Body; Putrefaction in Air and Water, and its conditions; the Identity of Bones, Skeletons, and Mutilated Remains; Sudden Death; the Presumption of Survivorship; Spontaneous Combustion; Life Insurance and Medical Evidence. In addition to these subjects new facts and cases have been added to every section of the work, the greater part of which has been rewritten. Engravings have been introduced into those chapters which admitted of illustration. Under the subject of Poisoning, the crystalline forms of mineral and organic poisons have been engraved from specimens observed with the microscope: the leaves and seeds of poisonous plants are also represented, the leaves being engraved from photographic copies of the natural leaves, showing their complete form and structure, and the seeds of their natural size and shape, as well as magnified. Under Wounds, illustrations of the principal organs and cavities are given, so as to render the description of wounds by medical witnesses more intelligible to members of the legal profession. Other subjects, which it is here unnecessary to specify, will also be found to have their appropriate illustrations.

The small volume will be republished as hitherto, to serve as a Manual for the use of students of Law and Medicine.

15 St. James's Terrace, Regent's Park:
September 1865.

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CORRIGENDA.

At page 177, 15th line from top, for ‘twenty-three’ read ‘thirteen.’
,, 339, illustration, Fig. 4, for ‘24’ read ‘124’ diameters.
,, 359, 25th line from foot, dele ‘somewhat.’
,, 361, 10th line from top, for ‘like’ read ‘unlike.’
,, 414, 15th line from foot, for ‘was’ read ‘were.’
,, 417, last line, after ‘hand’ insert the words ‘of the deceased.’
,, 422, 17th line from top, for ‘falled’ read ‘fallen.’
,, 423, 22nd line from top, dele the comma after the word ‘any.’
,, 442, 9th line from top, for ‘Fluck’ read ‘Flack.’
,, 453, 24th line from top, for ‘spinal cords’ read ‘spinal cord.’
,, 480, 18th line from top, for ‘effect’ read ‘effects.’
,, 601, 6th line from foot, for ‘Med. Jour.’ read ‘Med. Jur.’
,, 607, 25th line from top, for ‘statements’ read ‘statement.’
,, 825, 15th line from top, for ‘1862’ read ‘1863.’
,, 1056, 26th line from top, for ‘reponsible’ read ‘responsible.’

MEDICAL EVIDENCE.

THE PRACTICE OF MEDICAL JURISPRUDENCE—MEDICAL AND MEDICO-LEGAL DUTIES CONTRASTED—MEDICAL REPORTS—CORONERS' INQUESTS—INSPECTIONS—MEDICAL WITNESSES—TRIAL AT THE ASSIZES—SUBPŒNAS—EXAMINATION IN CHIEF—CROSS-EXAMINATION AND RE-EXAMINATION—QUOTATIONS FROM BOOKS—PRESENCE OF WITNESSES IN COURT—RULES FOR THE DELIVERY OF EVIDENCE—MEDICAL EXPERTS—MEDICAL COUNSEL—CONFLICTING MEDICAL TESTIMONY.

MEDICAL JURISPRUDENCE—or, as it is sometimes called, FORENSIC, LEGAL, or STATE MEDICINE—may be defined to be that science which teaches the application of every branch of medical knowledge to the purposes of the law; hence its limits are, on the one hand, the requirements of the law, and on the other, the whole range of medicine. Anatomy, physiology, medicine, surgery, chemistry, physics, and botany, lend their aid as necessity arises; and in some cases all these branches of science are required to enable a Court of Law to arrive at a proper conclusion on a contested question affecting life or property.

Medical jurists are by no means agreed upon the exact boundaries of their science. Some authorities include forgery and coining, and all offences requiring purely chemical evidence; others include feigned diseases, nuisances, and subjects connected with public health or sanitary legislation; while one German writer introduces the government and regulation of Temperance societies. Those who thus propose to enlarge the science forget the maxim, '*Ars longa, vita brevis*;' and they also forget that, by demanding too much of a medical practitioner, they may deter him from undertaking the study of that portion which may really prove serviceable to him in the practice of his profession.

The purpose of this work has been to bring as far as possible within a reasonable compass those subjects which especially demand inquiry, and which more particularly concern the duties of the educated physician and surgeon. The definition above given necessarily implies that a medical urist should have a theoretical and practical knowledge of all branches of the profession, a large range of experience, and the rare power of adapting his knowledge and experience to emergencies. He should be able to elucidate any difficult medico-legal question which may arise, and be prepared at all times to make a cautious selection of such medical facts, and a proper application of such medical principles, as may be necessary to enable a judge to place the subject in an intelligible light before the jury, and to enable a jury to arrive at a just conclusion.

Medico-legal knowledge does not consist so much in the acquisition of facts as in the power of arranging them, and in applying the conclusions to which they lead to the purposes of the law. A man may be a most skilful surgeon, or a most experienced physician; his mind may be well stored with professional information; yet if he is unable by the use of simple language to make his ideas known to others, his knowledge will be of no avail. One far below him in professional standing and experience may make a better medical witness.

The variety of subjects in which a medical jurist is required to have knowledge and experience may well alarm a student of medicine, and lead him to suppose that, as he cannot make himself perfectly acquainted with all, he may well forego the labour of preparing himself in any. But this would be taking an erroneous view of his position. This description of the qualifications necessary to constitute a normal witness in a Court of Law must not deter him from entering on the study. It is assuredly beyond the mental power of any individual that he should be at the same time profoundly versed in all the principles of medicine and jurisprudence, and that he should be able to answer all possible questions, and encounter and remove all medical difficulties that may occur during the trial of a civil or criminal case. All that the law expects from a medical man is a fair average knowledge not merely of his profession, but of that which falls more peculiarly under the province of a medical witness. There can be no doubt that the more perfectly a man has made himself master of his profession, the better will he be fitted to follow the principles and apply himself to the practice of medical jurisprudence; but he must divest himself of the notion that these principles can be spontaneously acquired, or that they are necessarily derived from the study of those isolated branches of medicine upon which medical jurisprudence is based. The materials for the medical jurist undoubtedly exist in these collateral sciences: but they require to be assorted, selected, and moulded into shape, before they can be applied to any useful purpose. A man may be well qualified to practise as a physician or surgeon, and yet find himself deficient when called upon to act as a medical witness. There was no doubt that John Hunter stood in his time at the very head of his profession, and that none could have profited more by industry and experience. If sound professional knowledge could have qualified any man to act as a medical witness, we should assuredly be justified in pointing to him as an example; and yet this great man, when summoned to give evidence on a memorable trial for poisoning, which occurred in 1781, was obliged to confess that he was unable to give a satisfactory answer to the important question put to him. John Hunter was the only professional witness called on the part of the prisoner to rebut the charge of poisoning the deceased by laurel water. His cross-examination, however, rather strengthened the case for the prosecution;

and the final question put by the Court was: 'Give your opinion in the best manner you can, one way or the other, whether upon the whole of the symptoms described, the death proceeded from the medicine (laurel water), or any other causes?'—*A.* 'I do not mean to equivocate; but when I tell the sentiments of my own mind, what I feel at the time, I can give nothing decisive.' With that candour which exists in all great minds, John Hunter admitted his deficiencies; and he regretted to the latest period of his life that he had not directed more attention to subjects of this nature. It is perfectly clear from his answer that he should not have appeared in the case at all. In John Hunter's time medical jurisprudence was unknown; but the want of it was clearly perceived. It was made apparent from the events of this remarkable trial (*Rex* v. *Donellan*, Warwick Lent Assizes, 1781), that a peculiar kind of experience was required to fit a medical man to act as a witness in a Court of Law,—that many loose principles existed in medicine, surgery, and chemistry, the fallacies of which were quite unimportant so far as they related to medical practice, but which required to be closely sifted and thoroughly examined before they could be received as evidence in law. Medical men were then as now apt to confound what is mere matter of belief with proof. In a Court of Law, however, the difference is soon made apparent. From the occurrence of this and similar cases, there was an obvious necessity for the creation of a distinct branch of science in which all medical facts and principles capable of serving as evidence should be arranged, developed, and explained.

The duties of a medical jurist are distinct from those of a physician or surgeon: the latter looks only to the treatment of disease or accident, and the saving of life; but the object of the former, in a large proportion of cases, is, whether in reference to the living or dead, to aid the law in fixing on the perpetrator of a crime, or to rescue an innocent person from a falsely imputed crime. Thus he may be required to determine whether, in a particular case, the cause of death is natural or violent; and for this purpose it will be necessary for him to make an entirely new application of his professional knowledge. He has now the difficult task of making a selection from those parts of the medical sciences which bear upon the legal proof and development of crime.

Some members of the medical profession have been inclined to look upon medico-legal practice as an unnecessary addition to their ordinary duties; but there are few who have been long engaged in the practice of the profession who have not found themselves occasionally placed in situations of difficulty from the accidental occurrence of cases demanding medico-legal investigation. A medical man is summoned to attend a person labouring under the effects of poison criminally administered, but at the time he may have no knowledge or even suspicion that poison is the cause of the symptoms. In spite of the best treatment, death ensues: here the functions of the medical man end, and those of a medical witness begin. It is utterly impossible that he can now avoid giving evidence, or shift the responsibility on another—the law will insist upon his appearance, first in the Court of the coroner, and afterwards at the Assizes. It will here be assumed that as a registered member of the profession he is fully competent to answer every question put to him by judge and counsel relative to the general effects of poisons; the quantity of each required to destroy life; and the time within which a poison may prove fatal. It may be objected to his evidence, that the deceased had died from the effects of disease and not from poison, in which case the cross-examination will lead to a searching inquiry into all those diseases which resemble poisoning in their symptoms and post-mortem appearances, as well as the means of making a certain distinction between them, and the fallacies to which the chemical processes for the detection of poison are liable. On another occasion, a medical man may be called to render assistance to one who has been stabbed in a quarrel, and who speedily dies from the wound. The office of the surgeon here ceases, while that of the medical jurist commences. He must now be prepared to answer numerous questions, all bearing upon the legal proof of crime—all necessary in law, although apparently superfluous in surgery. Thus he may be asked to state the precise characters of a wound inflicted upon the body of a man soon after death, and by what means a particular wound was inflicted. Was it homicidal or accidental? The amount of blood lost? Whether the person could have moved or performed any act after receiving it? Are certain red stains found upon his clothes, or upon a knife belonging to him, owing to effused blood or other causes? Whether any and what statements were made by the dying man, and what were the precise circumstances under which they were made? (See p. 379.) It need hardly be observed that questions of this nature are rarely noticed, except in a cursory manner, by professors of chemistry and surgery, and a medical man is not likely to acquire the means of answering them by intuition. On the other hand, regarding ourselves as living in a civilized state, in which the detection and punishment of crimes against life and property are indispensable to the security of all, it is impossible to overrate their importance. Unless a witness is able to return answers to these questions when a public necessity occurs, a guilty man may escape punishment, while an innocent man may be condemned. He may thus most seriously injure his own reputation; for it is certain that his qualifications as a physician, surgeon, or general practitioner, however great, will not shield him from general reprobation.

Thus, then, it is obvious that the duties of a medical jurist are of a highly responsible nature and of great importance to society, while the cases which call them into exercise are of purely accidental occurrence. A medical practitioner who thinks himself secure in the most retired corner of the kingdom, is liable to find himself suddenly summoned as a witness on a trial, to answer questions which perhaps during a long period of practice he had been led to regard as trifling and unimportant. Under the circumstances it is scarcely possible that he can avoid exposing his deficiencies, and the final question will be, *Have you ever attended to or thought of these subjects before?* A negative answer to this question, while it commonly brings with it public censure, will in most instances lead to the acquittal of the accused in spite of strong presumptions of guilt.

I have endeavoured to avoid overdrawing this picture; its truth will, I am sure, be felt and acknowledged by those who have been a few years engaged in practice. The records of our law courts contain many unfortunate exposures, which might have been easily avoided, had the witnesses only availed themselves of the opportunities afforded to them of acquiring a knowledge of the subject; but they had unreflectingly acted on the principle, that medical jurisprudence was a dry, dull, and useless study, and that the practice of it was remote and speculative. This feeling is, however, fast disappearing. Those who have been compelled by circumstances to give their attention to it, have in subsequent cases taken care to prepare themselves for the ordeal through which every medical witness must pass.

Some medical men who have treated legal medicine with indifference have occasionally ventured to act as witnesses, thinking that the subjects on which they were likely to be examined were so little known to judge and counsel, that even hazardous or rash statements would escape observation: such witnesses, however, have often found to their cost that they were labouring under a fatal delusion. Various circumstances have led, in recent times, to the acquisition of much medico-legal knowledge by lawyers, more especially in relation to questions connected with wounds, child-murder, and poisoning; and they are not slow in detecting and exposing a mere pretender who attempts to shelter himself by vague or evasive statements and technical language.

There are few counsel engaged in any civil or criminal case of importance who do not take care to fortify themselves under medical advice, with a full knowledge of the views of standard medical writers on the subject in dispute; and with these works before them, and with their proverbial acuteness, he must indeed be a clever witness who can succeed in passing off an erroneous or evasive answer to a medico-legal question.

It is a frequent charge against members of the medical profession, that in a Court of Law they are the worst witnesses on matters of fact and opinion. I believe this to be an unmerited censure. Those who are ready to make this charge overlook the complexity and difficulty of the questions which are put to medical men compared with those put to other witnesses. They also forget that medical men are much more frequently summoned as witnesses than the members of the two other learned professions. Their evidence obtains much greater publicity, and is necessarily exposed to greater criticism. I was, on one occasion, present at a trial before the late Lord Truro, in which the action was between two members of the legal profession, and the witnesses on both sides were chiefly barristers, solicitors, or solicitors' clerks. The questions put to the witnesses were so cleverly met and so technically evaded, that it was scarcely possible to obtain a consistent history of the most simple facts of the case. A direct answer could not be procured on any question, and the mode in which the witnesses gave their testimony elicited on several occasions rebukes from the learned judge. The fact is, that good and bad witnesses are to be met with in every profession; under equal conditions there is no reason to suppose that one would furnish a greater number of incompetent witnesses than another. It is certainly the fault of medical men that they are not generally prepared for the questions which are likely to arise in a case on which they know they will be required to give evidence. This want of preparation frequently applies to facts as well as to opinions. Thus, in reference to a case in which a charge of murder or manslaughter may be ultimately founded, a medical man who is called in omits to observe many circumstances because they appear to him to have little importance, although at the subsequent trial he may find, to his dismay, that they actually become the turning points of innocence or guilt. Medical observation as a result of professional habits is, on these occasions, in general confined to only one set of circumstances—the recognition and treatment of disease; but medico-legal observation should take a much wider range than this, and should be directed to all the surrounding facts and incidents of a case. The essential difference in the two kinds of practice is, that circumstances which are of no interest in a medical or surgical point of view are often of the greatest value and importance in legal medicine. It is obvious that if they are not observed by the medical witness when he is first summoned to the injured person, whether dying or dead, it will be out of his power to meet many of the questions which must arise in the progress of the case. The non-observance of these facts is a serious evil, and often carries with it, although unjustly, an imputation of professional ignorance.

The first duty, therefore, of a medical jurist is to cultivate a faculty of minute observation of medical and moral circumstances. This, when combined with a general knowledge of what the law requires as evidence, will enable him to meet in a satisfactory manner all the scientific questions that may be necessary for the elucidation of a case. The exercise of this faculty is by no means inconsistent with the performance of his duties as a surgeon. Some eminent professional men have been known to possess this power as a natural gift. I have elsewhere given a short notice of a case which occurred to the late Sir Astley Cooper (p. 425). He was called to see a man who, while sitting in his chair in a private room, had been mortally wounded by a pistol-shot from the hand of an unseen person. Sir Astley having done what was necessary respecting the wound, compared closely the direction from which the pistol was fired with the position of the wounded man, and he came to the conclusion that the pistol must have been fired by a left-handed man. The only left-handed man known to be on the premises at the time was an intimate friend of the deceased, against whom there was no suspicion; but this observation led to his arrest and trial, and he was subsequently convicted of this act of murder.

The condition and position of the body of a person dead from wounds, the position of a weapon, and the state of the dress and weapon, as well as the form and direction of the wound itself, are not always noticed with sufficient accuracy. It is, however, only right to say that many medical men in the present day show great acumen in their examination of these cases. I was lately present at a trial for murder in which the evidence showed that a man had been stabbed in the chest, and he died almost instantly from a wound in the heart. The act had been perpetrated by some one in a crowd in the dusk of the evening, but no one was seen to strike the blow, and no weapon was found near the spot. The surgeon observed that the wound in the chest was sharp at one angle and rounded at the other, and he gave his opinion that the wound had been inflicted with a knife having a sharp edge, and not with a dagger or double-edged knife. Within a few hours after the occurrence, a man was arrested on suspicion, and a knife which he attempted to conceal was taken from him. It was in a sheath, and had at this time *wet* blood upon it, showing a recent use of the weapon. It was a pointed knife, with a broad blade, and one sharp edge only—such a weapon as, in the opinion of the surgeon, would have produced the stab in the chest. The man was tried and convicted, the observation of the surgeon respecting the state of the wound and the weapon furnishing important evidence of his guilt. On the other hand, want of observation may lead to the discharge of guilty persons. I have elsewhere noticed a trial for murder which took place in Scotland (p. 423). A woman was found dead in her bed with some lacerated wounds of the scalp: there was strong reason to believe that these had been produced by criminal violence, but it was suggested for the defence that as there were projecting nails at the head of the bed, these lacerations might have arisen from accident—a suggestion supported to some extent by the medical evidence. An experienced witness, however, stated that from his examination he did not believe that the nails, even if they were in the bedstead at the time of the occurrence, could have produced the wounds. He also said that as blood had issued from the wounds, and there was no blood about the nails or this part of the bed around them, he did not believe that the head had at any time come in contact with the nails. Those who were first called to the dead body had omitted to notice whether there was anything on or near to the bed to account for the wounds on the scalp, and they were quite unable to say whether there were or were not any projecting nails at the head of the bed when they first examined the body. The prisoner was discharged on a verdict of 'Not proven;' and there was some reason to believe that he escaped through manufactured evidence, i. e. that the nails had been driven into the head of the bed subsequently to the death of the woman. At any rate, it seems perfectly clear from a general view of the medical evidence, that the wounds could not have been produced by the nails in the manner suggested, and that the wounded portion of the scalp had not at any time been in contact with them. As they were lacerated wounds, and so might have been produced by nails, the accused had the benefit of the doubt which was thus raised in the minds of the jury.

The learned judge who tried this case remarked that '*a medical man, when he sees a dead body, should notice everything.*' Undoubtedly he should observe everything which could throw a light upon the production of wounds or other injuries found upon it. It should not be left to policemen to say whether there were any marks of blood on the dress or on the hands of the deceased, or on the furniture in the room. The dress of the deceased as well as the body should be always closely examined on the spot by the medical man. The importance of this precaution is well illustrated by a case related at p. 404, in which a man just escaped committal on what would have proved a false charge of murder, by reason of the examination of an article of dress accidentally produced at the adjourned inquest.

There is another point which is frequently omitted on these occasions, and the omission may give rise to great inconvenience if not to a failure of justice. Thus, in reference to a dead body, no observation is made at the time of the visit whether it or any part of it is cold or warm; whether the limbs are cold and rigid, or cold and pliant. In a medical and surgical view these conditions of the body are of no importance whatever, but medico-legally, if the facts are observed, they may enable a witness to speak with greater or less probability on the time of death: this may make all the difference between the acquittal and conviction of a person charged with murder. The case of *Gardner*, of which a notice will be found at p. 40, shows the importance of observations of this kind. The circumstances which chiefly require notice on these occasions have been fully described in Chapter 35. In reference to supposed death from poison, other matters will also require special attention. These will be found in detail in Chapter 11.

It may stimulate the attention of a medical practitioner in reference to these inquiries, if he is informed that the great art of counsel who defend persons charged with murder or manslaughter consists in endeavouring to discover what he omitted to do. Although sometimes the omission may be really of no medical importance whatever, yet it is usually placed before the jury in such a strong light that the accused obtains the benefit of a doubt. The omission may be attributed to professional ignorance, or, what is worse, to professional bias—a determination to find proofs of guilt against the 'unhappy prisoner at the bar'—when the facts might be innocently explained by a want of experience on the part of the witness in dealing with cases of this nature.

Medical Reports for Inquests.—If we except medical experts, who are selected according to their experience in different branches of the profession, medical men have no option respecting medico-legal practice, for the cases which give rise to medico-legal questions are always more or less connected with the practice of medicine and surgery. The initiation of criminal proceedings in England and Ireland is generally in the court of the Coroner. Unless the medical man is supposed to be implicated by maltreatment or otherwise in the death of the person, an order is issued to him to make an inspection of the body and report the results. In reference to wounds, the points to which he should especially direct his attention will be found described at p. 382; in reference to poisoning, at page 153; and to alleged child-murder, at pages 885 and 890. It is proper that at the time of the inspection and analysis he should make notes of all that he observes and does; and upon this he may base a report, which should be a summary of the medical facts, and of the conclusions based upon them expressed as much as possible in untechnical language. In Chapter 11, the reader will find a description of the course to be pursued on such occasions, as well as of the circumstances under which notes are permitted to be read; and at page 158 the rules for drawing up medico-legal reports are also fully explained.

There are frequently defects in these reports which it is desirable to point out. The statements are sometimes drawn up in exaggerated language: at others they are overloaded with technical and therefore unintelligible terms, and the writer is seldom sufficiently careful to keep his facts distinct from his comments. The former may be useful as evidence; the latter are inadmissible.

With respect to the first of these defects, it is very much the practice of medical men, in drawing up reports of medical cases for professional purposes, to use, unthinkingly, exaggerated language. Thus it may be observed in the drawing up of an ordinary post-mortem examination, the lining-membrane of the stomach is described as being 'intensely' inflamed; or some part is 'considerably' injected, or a cavity is 'enormously' distended. Expressions thus loosely employed convey to the legal mind a widely-different meaning from that intended by the reporter. They create also great difficulty in evidence if withdrawn or modified—a change which other circumstances may show to be necessary, and at the same time they place the witness in an undesirable position before the Court. On the other hand, if retained, they may render the facts unsusceptible of explanation upon any theory of natural disease. Such descriptions obviously imply a comparison with similar conditions in numerous other dead bodies; but what is the standard by which they are really measured, and what opportunity has the witness had of creating such a standard in his own mind? In general, it will be found that such expressions have been used without proper consideration, from a habit acquired by the writer in reporting cases for the information of medical men only. Let him who is inclined to use them bear in mind that barristers look much more closely to the strict signification of words than medical men, and that they are always disposed to distrust the judgment of one who cannot speak or write without resorting to the use of the superlative degree.

The free use of *technical terms* in drawing up reports may be attributed to a similar practice in the profession. Putting aside those cases in which a medical man thinks he is displaying his erudition by the selection and use of such terms, there can be no doubt that the greater number of medical practitioners fall into this practice from mere habit. They think they are addressing the report to the president and members of a medical society, instead of a coroner and jury who have never in their reading or experience met with such terms, and to whom therefore they are perfectly unintelligible. In a report on the appearances in the body of a man who had suffered from chronic insanity, which was submitted to me for explanation, the following passage occurred:—'The only morbid appearance in the brain was an atheromatous deposit in the Pons Varolii, near the situation of the locus niger.' In another document, the reporter stated, for the information of a coroner's jury, that the 'integuments of the cranium were reflected, and the calvarium was exposed.' If a reporter will use such terms as these or others of a similar kind, such as 'parietes of the abdomen,' 'epigastrium,' 'hypertrophy of the liver,' when it would require no more trouble to put what he means in plain English, he must be prepared to have his meaning perverted or wholly misunderstood. Setting aside the men who act as jurors, it may be observed that educated persons, such as coroners and magistrates, do not commonly include professional terms within the range of their studies. There are but few of them who understand the difference between perineum and peritoneum, or the meaning of the words hemispheres of the brain, pia mater, puncta cruenta, corpora quadrigemina, centrum ovale, &c. They are not likely to know the difference between the cardia and pylorus, nor the nature or situation of the duodenum, jejunum, ileum or cæcum, and are as ready to consider them to be parts of the liver or urinary bladder as of the intestines. On one occasion, I heard a learned judge ask for an explanation of the meaning of the term 'alimentary canal.' A slight consideration will show to any medical practitioner that refined professional language is wholly misplaced in a report which is intended to inform and convince the minds of ordinary men upon plain matters of fact.

The last point which calls for comment in reference to medical reports, is the loose manner in which facts and comments on facts, as well as hearsay statements, are sometimes found blended. If a reporter takes care to eliminate facts from comment, his report is admissible, and may be read at the inquest or trial as evidence. The facts are for the jury,—the comments upon the facts, introduced by the reporter, may or may not be just, and are therefore not evidence. Their correctness or relevancy to the case will be elicited in the cross-examination. As a rule, nothing should be entered in a report which is not connected with the subject of inquiry, and which has not actually fallen under the observation of the reporter. The introduction of hearsay statements—i.e. statements made by others, or of circumstances which have come to his knowledge through public rumour—should be carefully avoided.

In the case of *M'Lachlan*, who was tried for the murder of Jessie M'Pherson, at the Glasgow Autumn Circuit, 1862 (see p. 42), some discussion arose upon what should and what should not find a place in a medical report. A report was put in at the trial, in which the surgeon of police, who had been authorized to make a post-mortem examination of the body of deceased, stated, in commencing his report, that the body had been found '*under circumstances of great suspicion*,' in a front room, &c. The judge, Lord Deas, here remarked that this was matter which was not suitable to a medical report. So again, in reference to the conclusions drawn, the first and third were as follows :—

1. 'That this woman (the deceased) was *murdered*, and that with extreme ferocity.'

3. '*That a severe struggle had taken place before death.*'

The suggestion of murder was an anticipation of the verdict of the jury. As a general rule, conclusions are limited to the *cause of death*, and no reference is made to ferocity. This passed without comment, but the third conclusion led to the following examination :—

Q. You say that in the kitchen there was evidence of a severe conflict having taken place. What was the nature of that evidence?

A. There were blood-stains upon the end of the jaw-box, at the inner side of the kitchen door.

Q. But what led you to say there were marks of a severe conflict?

A. These marks were principally upon the flags.

Q. How did that show that there had been a severe conflict? The dragging of the body was not a sign of a severe conflict. I therefore want to know what marks of a severe conflict were apparent to you before the dragging commenced?

A. My conclusion that there was a severe conflict was founded upon the streaks which were upon the kitchen floor.

Q. I again ask, what were the marks of a severe conflict before the dragging (of the body) took place?

A. There were regular marks, as if caused by some rough substance.

The *Judge* (*Lord Deas*) to witness: That is streaking still, and the remark in your report about 'evidence of a severe conflict' just confirms what I have said already as to the introduction of matter not proper to a medical report (Report of trial, p. 37).

The difficulty here arose from the introduction of comments into the report. There was no evidence of conflict or struggle, as far as this examination goes. The facts upon which the witness relied as evidence of a struggle were equally consistent with the dragging of the body after death.

In a medical report of an analysis in a case of suspected poisoning, it is not necessary that all the details of an analysis should be entered. A general statement of the results, to the effect that certain tests and processes had been used, will be sufficient. In the various analyses connected with the case of J. P. Cook and Ann Palmer (*Reg.* v. *Palmer*, C.C.C., May 1856), an application was made to Dr. Rees and myself to give to the prisoner's attorney, before the trial, a statement of the whole of the details of our analysis for antimony and strychnia. We declined to do this without authority. The Queen's Bench was appealed to, and Lord Campbell decided that there was no legal ground on which such a demand could be enforced. Considering that the medical evidence against the prisoner was so clear and conclusive, the counsel for the Crown advised that we should concede the point, although admitted to be neither in accordance with law nor custom. Upon this advice we acted, but it is not a course which I should recommend any scientific witness to follow in a future case. The result was that, before the trial, these private memoranda were placed in the hands of some professed chemists retained for the defence, whose object was simply hostile criticism. Portions of them appeared in a garbled and fragmentary, and therefore in an incorrect, form, in some journals and newspapers, with comments attacking the processes and conclusions before our evidence had been given. It was well known to those who had been guilty of this unprofessional conduct, that under the circumstances, we, as witnesses for the Crown, were precluded from making any reply or giving any explanation. The object, however, in this memorable case, was not truth, but victory. No medical man is called upon to ay himself open to attacks of this nature, or to furnish materials for a cross-examination to 'medical counsel' acting only in the interests of a prisoner. n regard to the chemical research for poisons, chemists generally differ about he process which it may be desirable to pursue in a given case; and although the same result may be reached by various methods, it is by no means difficult to find one who will assert that his is the only correct process, and that all others are fallacious, or to raise by such counter-statements that kind of doubt in the minds of a jury which may lead to the discrediting of the witness's results.

Upon a medical report, and such evidence as may be required to explain it, an accused person may be committed for trial at the Assizes, either by a coroner or magistrate. In the first stage of proceedings under these circumstances, the medical witness goes before the Grand jury, and there, after the administration of an oath, he is required to make a general statement of what he knows of the matter. Such questions are put as may be necessary to elucidate the cause of death; and on the finding of a true bill for murder or manslaughter, the accused is placed upon his trial before one of the learned judges of assize. According to the variable circumstances attending such cases, the medical evidence is called for at an early or late stage of the proceedings. When it is at all doubtful whether the cause of death was owing to any criminal act, it is called for at the commencement of the case in order to lay a foundation for further inquiry.

It is necessary that a medical witness should remember that copies of his report and depositions, either before a coroner or magistrate, are usually placed in the hands of counsel as well as of the learned judge, and that his evidence, as it is given at the trial, is compared word for word with that which has been already put on record. There is reason to believe that this is not generally known to members of the medical profession, and thus it happens that either from failure of memory, want of accurate observation, or carelessness in giving evidence at coroners' inquests, medical witnesses lay themselves open to severe censure, either by stating matters differently at the trial, or by giving a very different complexion to the facts. Any serious deviations from what is on record will of course tell unfavourably for the witness, supply materials for a severe cross-examination, and form an excellent ground of defence for the prisoner. The witness's weakness is the prisoner's opportunity, and of course his counsel will not lose the occasion of impressing upon the jury that a man who can on oath give two different accounts of the same transaction is not to be believed on either.

Coroners' Inquests.—The proceedings at Coroners' inquests are treated too lightly by medical men. The ignorant and uneducated class of persons who often constitute the jury, as well as the circumstances under which the inquiry usually takes place, are not calculated to inspire great respect for these initiatory proceedings; but still by law and custom coroners' inquisitions are and have been for ages in this country the only tribunals for inquiring into and determining the cause of death in cases of suspected violence; and they are therefore deserving of more attention than is usually shown to them by medical witnesses. The observations made at p. 885 in reference to inquests in alleged child-murder apply to all other cases demanding medical evidence. As a rule, in all inquests which are likely to end in a committal of the accused person, a medical man who is giving his evidence before a coroner, in the room of a small country inn, or in a village school-room, is virtually delivering it before a judge of assize; and this fact alone, if not a respect for the Court, should induce him to give the evidence guardedly, and with a due consideration to the serious results to which it may ultimately lead.

Coroners' inquisitions are so intimately associated with the practice of medical jurisprudence in reference to criminal cases, that it is impossible to pass over this subject without pointing out what must be regarded as the defects of this method of inquiry.

The 4th Edward I., stat. 2, on which coroners profess to act, directs that, 'upon information,' they shall 'go to the place where any be slain or suddenly dead,' and make due inquiry as to the cause, &c., before a jury selected from persons living in the neighbourhood. The information upon which a coroner generally acts is,—1. Notice from a beadle, or other officer of the parish (whose zeal is sometimes stimulated by a fee or salary) of any death from sudden or supposed unusual causes. 2. Notice from a medical man who may have attended the deceased, and who communicates his suspicion that the cause of death is not natural. 3. Notice from a registrar of deaths that no cause has been assigned in a particular case, or that there has been a rapid death after a short illness.

The conclusion to which experience leads in reference to these inquiries is, that the system affords no certainty for the detection of crime; that it affords no protection to those who are wrongly charged with crime; and lastly, that in some cases it screens a criminal by a verdict based upon an imperfect inquiry, in which the important medical facts are either not understood or are misinterpreted by the jury.

Admitting that some crimes (which might have remained concealed) have been brought to light by this system, it is my opinion that, as the inquiry is now conducted, it fails to exercise any deterring influence on criminals.

In a large proportion of cases, no inspection of the dead body is made. This is probably in order to avoid the expense of a post-mortem examination. It would be easy to point to cases in which death by poison has been thus concealed, and the fact has only come to light by accident some years afterwards. With rare exceptions, indeed, is it justifiable on the part of a coroner to hold an inquiry on a dead body without a strict external and internal examination of the body. Either the inquiry is necessary, or it is not. If not necessary, the coroner is to blame in holding it; if necessary, an inspection of the body is the very essence of the inquiry, where it refers to one who 'has been slain or is suddenly dead.'

I was once an attendant at a funeral; it was delayed, and the cause of the delay was simply this:—An inquest had been held on the body (a case of very sudden death in a state of health), and a verdict of 'Death from disease of the heart' had been returned. There had been no inspection of the body. When the grave-clothes were removed, and the body was examined, it was found to be covered with bruises, and some of the muscles of the thigh were reduced to a jelly. Death had been clearly caused by violence. But an inquiry before a coroner for two days had, with all the usual formalities of medical evidence, &c., resulted in a verdict of 'Death from disease of the heart.' Within two hours only of the body being put into the ground, it was clearly proved to be an act of murder or manslaughter. The guilty party was tried, convicted, and punished. (*Reg.* v. *Hopley*, p. 471.) This case, with several others of a similar kind, establishes two propositions. The coroner's inquest affords no certainty for the detection of crime. It, in some cases, tends to screen a criminal.

The secrets of the grave are only known to those who practise medical jurisprudence. In the course of the last thirty years, at least fifteen cases of the exhumation of dead bodies have been referred to me. On some of these, inquests had been held, but no inspections were made. Verdicts of death from cholera or natural causes had been returned, and, at intervals of from one month to twenty-two months, the bodies have been disinterred, and it has been then proved that the deceased had died from poison. In some of these cases the deaths were sudden, and in others slow; in the latter the symptoms during life were mistaken for those of disease, medical certificates of the cause of death were given without sufficient inquiry, and thus it is that crime passes undetected, and several lives may be destroyed in succession before a criminal is arrested. There is a popular notion in accordance with the ancient statute, that sudden deaths only require an investigation by the coroner; but this is an error. A large proportion of sudden deaths take place from well-known natural causes, easily elicited by a proper medical inquiry, and they strictly demand no judicial proceedings. On the other hand, in all cases of chronic poisoning, the form which secret murder has of late years assumed, the person has lingered on with intermitting symptoms, and death has taken place only after an illness of some weeks' duration. There is no provision for the detection of such cases. Their discovery appears to be a matter of accident.

As a rule, it may be said that all inquests in which there has been no medical inspection of the body are a vain mockery, and the sooner the public mind is imbued with this proposition the better for society. It is not implied that the bodies of all persons who die suddenly should be inspected. If circumstances of a suspicious kind justify an inquest, *ipso facto* there should be an inspection. If an inspection is not required, an inquest is not required. Such cases as inquiries into deaths from machinery, railway accidents, &c., where the physical injury is obviously sufficient to account for death without further inspection, are excepted from this remark.

The verdicts of coroners' juries are sometimes quite erroneous and contrary to the medical evidence. Great injury is thus done occasionally to innocent persons. At the Assizes the bill may be thrown out by the Grand jury; but the person inculpated by the verdict may always have a stigma attached to his character, as a result of mistake or misapprehension of medical evidence, or, sometimes, of local prejudice.

Many persons who occupy the office of coroner are neither medically nor judicially qualified for the proper performance of the duties of the office. The system of electing a man to hold such an office as this (one demanding special *medical* knowledge of the causes of death, and good *legal* knowledge of the law of evidence) by freeholders of the lowest degree, is so intrinsically absurd, that it is quite wonderful how, with improved knowledge and the advance of civilisation, it has maintained its ground in such a country as England. The election of a Lord Chancellor, of the judges of our Courts of Law, or of County Court judges, might be with equal reason left in the hands of voters of this class,—men who have no knowledge of the duties of the office, or of the skill and learning required in one who is really competent to fill it. The election of a good and capable person as coroner is, therefore, a matter of pure accident. No preliminary test of ability or capacity is required.

In Scotland, the office of coroner does not exist; but in place of this there is an officer named Procurator Fiscal, generally a skilled solicitor, nominated by competent authority, and not elected by scot and lot voters. The general order issued to these officers by the Lord Advocate enjoins that in cases where a dead body is discovered, the Procurator Fiscal shall obtain a medical report of the cause of death ; and in cases of persons found dead, the body is generally inspected for this purpose. This, however, is at the option of the appointed officer, the instruction being in these words :—'Wherever in his opinion a written medical report is necessary for the due consideration of the case, he, the Procurator, shall obtain such a report from a duly-qualified medical practitioner.' The usual practice in England is to select the *nearest* medical practitioner, whether he has had any experience or not, and often to trust an important chemical inquiry in the hands of one who probably has never before made an inspection or an analysis for poison.

The steps necessary for the proper identity and preservation of viscera, or other articles for analysis, are neglected. The stomach is cut open, and the contents may be entirely lost. The stomach containing poison is thrown into the same vessel with other viscera, and thus all are impregnated with poison. Evidence of absorption and diffusion of poison through the body during life is thereby entirely destroyed. Stomachs have been sent for analysis wrapped only in brown paper. On one occasion, two stomachs (of children poisoned) were sent in bladders, unlabelled. The identity of these at the subsequent rial for murder could only be made out by the different colour of the string with which one bladder was tied. On another occasion, in a newly-papered room in which a body was examined, the stomach was wrapped in a portion of the paper-hangings lying about: these, as it happened, were coloured with n arsenical pigment, and the poison was thus transferred from the paper to he stomach.

The selection of the nearest medical man, or of any gentleman who will make n inspection and an analysis for the parliamentary fee of two guineas, in a case f murder by poison, generally leads to a large expenditure subsequently for a urther analysis before the trial, when the parts in which the poison would be ost probably found, have been destroyed. On such occasions it is the custom condemn severely the medical and chemical gentlemen, who have probably, r the first time in their lives, undertaken a case of this serious nature upon e express order of a coroner, with insufficient renumeration for its perform-ce. This is manifest injustice. The fault is in the system, and not in the men, who do their utmost to perform a difficult duty, for the first time, as well as they can.

If a coroner places the inspection of a body in the hands of one who is not well skilled in the appearances produced by poison or disease, it is obvious that a serious mistake may be committed which may implicate an innocent person. If he places a stomach for analysis in the hand of an inexperienced analyst, it is not the fault of the analyst (whose living depends on his practice) if he undertakes it, and falls into some grievous act of omission or commission. The error is rather with the system; and the sooner it is abolished, and a more reasonable mode of proceeding substituted, the better.

There is for these defects a simple remedy, which is often now resorted to by the coroner in cases demanding great medical and scientific skill—in other words, the evidence of *experts*. After a coroner's inquiry, the whole of the proceedings are sometimes directed to be re-heard before a magistrate or magistrates, who can analyse and sift evidence, and can bring the minds of educated men and trained lawyers to bear upon the facts. A proper analysis and inspection are then made, and the case in this complete form goes before an Assize court for trial. If this is done occasionally in cases of importance, why not in all cases that are now properly the subjects of a coroner's inquiry? Let a well-trained gentleman be appointed as a stipendiary judge in every county or borough; let him, upon the same sources of information as are now open to the Coroner, hold inquiries or not, according to his judgment. There are many coroners who are quite competent to fill such an office. In each county, borough, or district, there should be appointed, as in some States on the Continent a skilled surgeon—skilled in the inspection of the dead body, and in a knowledge of the causes of death; and a skilled chemist, skilled in the processes for the detection of poisons. To these three officers, and, if necessary, to assistants appointed by and under them, all inquiries into crimes connected with the death of persons should be exclusively remitted. Proper salaries for skilled surgeons and analysts would secure competent men, and probably turn out in the end to be less costly than the present system. The duties of sanitary officers (which are not heavy) might be shared by the medical and chemical gentlemen appointed to these offices.

Some such regulations as these must sooner or later be made if the public desire to have the duties of an important office properly fulfilled. The value of life is greater in England than in any other country; but this remark applies only to cases of crime which are actually detected, and to the prosecution and punishment of criminals. I believe that we are greatly inferior to other nations in our means for the scientific detection of crime and murder by secret poisoning. In the case of William Palmer (1856), there was evidence to show that his wife, his wife's mother, two of his children, his brother and one of his personal friends, had all died from poison under his roof, within two or three years before the death of Cook—for the murder of whom Palmer was tried and convicted. His wife had been poisoned by tartar emetic, and his brother by prussic acid. The deaths of at least two others in his house were probably violent. Where was the Coroner's inquest for the protection of life?

Inspections.—The necessity for appointing a skilled independent inspector of bodies in all suspected cases demanding inquiry, will be apparent from other considerations. Under the present system, a person who has destroyed the life of another by poison may be present at the post-mortem inspection of the body of his victim, and may use his efforts to defeat the objects of the inquiry. William Palmer, a medical man, was thus allowed to be present at the inspection of the body of Cook. He nominated the persons, one of them an inexperienced young man who had never before inspected a body in a case of death from poison, and he stood over them while they were engaged in the office. The stomach of the deceased when received for analysis was cut open throughout its length. The injury to this organ, by which at least a portion of the contents was lost, occurred during the inspection, and is said to have arisen from Palmer having accidentally (as it was alleged) pushed against the youth who was making the inspection! After the viscera had been placed in a jar and secured with a bladder, Palmer found an opportunity of cutting the bladder with a knife and inverting the jar, and this probably led to a further loss of the contents. In a case of exhumation in which I was consulted, the viscera had been carefully removed and placed (as it was supposed) in separate jars, which were properly secured and labelled. When the jar labelled 'Stomach and Contents' was opened by the analyst to whom it had been sent, it was found empty. From inquiries subsequently made, there was but little doubt that a person who was interested in preventing an analysis was permitted to be present at the inspection, and that he had taken the opportunity, when the inspectors were otherwise occupied, of removing the stomach from the jar and again secretly returning it into the abdomen before the body was sewn up or otherwise disposing of it. Acts of this kind should be impossible in the present day, and the best security against their occurrence would be the appointment of a skilled inspector in a district, to conduct all post-mortem examinations for coroners' inquests.

A charge of malapraxis is sometimes raised against a medical man in consequence of the death of a patient. The examination of the body may, by order of a coroner, be unknowingly placed in the hands either of a professional rival, or of a friend of the person inculpated. This is not just either to the practitioner or the public. There is nothing more easy, medically speaking, than to exaggerate appearances in a body, or to assign to the action of medicines, or to the use of surgical instruments, post-mortem conditions of the body to which an independent and experienced anatomical inspector would probably attach no importance. Supposing the question to be that a patient has died from an overdose of opium, said to have been found in the stomach—if the analysis has been intrusted by a coroner to any professional rival, or to an ncompetent analyst selected by him, the injury done may be irreparable. These are not imaginary cases: they have occurred and must occur until special inspectors and analysts are appointed in place of men who are now aken by chance, by the fact of their living in the vicinity, or of their being called to see the person while dying.

If a person has had poison administered to him feloniously and he recovers, the facts of the case are duly investigated by a magistrate, the evidence is carefully sifted, analyses are properly made when required, and the depositions are so drawn up as to form a correct basis of proceedings for the trial of the accused. If, however, the person dies from the poison, the case then goes before a coroner and a coroner's jury; and although the medical and other questions which arise are usually of greater importance, they are now dealt with by men frequently incompetent to understand them, and who are not always qualified to elicit the facts or put them into a proper shape for trial. Hence it is that, unless a true bill has been found by a Grand jury at the Assizes or the alleged criminal has been committed by a magistrate, no prosecution is commonly instituted. The proceedings taken before a coroner are in this case disregarded by counsel and judges.

There is no doubt that a large number of these officers might be retained with benefit to the public, but the system of nomination by election should be altered. Tried and competent men only should be appointed, and in place of a jury they should have the assistance of persons skilled in a knowledge of the causes of death and in conducting post-mortem examinations and analyses. Under the present system coroners are empowered by the Medical Witnesses' Act (6 and 7 William IV. c. 89) to issue an order for the attendance of any legally-qualified practitioner; a fee of two guineas is the maximum allowed for making a post-mortem examination, and, if considered necessary by the jury, a chemical analysis of the stomach and intestines. A penalty of five pounds is attached to disobedience of this order, except for reasonable cause. Mr. Rumsey has correctly represented the unsatisfactory position in which medical men are placed by such an arrangement. He observes: 'It is no discredit to a practitioner engaged in the toilsome routine of ordinary medical duties, if he should feel himself at a loss when called upon for a decisive opinion in some obscure case of poisoning or infanticide. His scanty opportunities for the study of these subjects and for making post-mortem examinations cannot suffice to qualify him for answering the delicate and important questions which he must answer before a jury can find a proper verdict.' . . . 'The custom of indiscriminately summoning medical practitioners of all sorts, and of all degrees of pathological knowledge and forensic skill, has sadly depreciated the value of medical evidence in courts of justice. Public confidence in the profession has been shaken, and the appearance of a "doctor" in the witness-box is but too often a signal for sport among gentlemen of the long robe.' ('Essays on State Medicine,' p. 356).

No man can be compelled to undertake that which he feels incompetent to perform, and some medical practitioners who have felt this want of experience have properly declined to make chemical analyses involving so serious a responsibility. It is thus that, in many cases of importance, analyses for coroners' inquests are now referred to chemical experts, and the practitioner discharges himself of that responsibility which the Medical Witnesses' Act imposes upon him without any adequate remuneration.

Before quitting this subject, it is necessary to observe that medical men are too ready to give their opinions of the cause of death for a coroner's inquest without making an inspection of the body. No man is compellable to give an opinion upon insufficient data, and if by the institution of a judicial inquiry there are grounds for believing that a death has not been natural, no medical opinion of the cause should be given in the absence of an inspection. Such an opinion must always be conjectural, and involve the medical man in an unpleasant responsibility. (See p. 696.)

Trial at the Assizes.—The next stage of the proceedings in a criminal case brings a medical witness before a superior Court. For this purpose a *subpœna* is issued. It need hardly be observed that every witness is bound to obey a subpœna, when with it his reasonable expenses for journey, &c. are endered to him, but he is not bound to attend at the trial except upon a subpœna. There are some questions connected with this subject which it will be proper to consider in this place. *If a subpœna is served on an ordinary or skilled medical witness, is he bound to obey it?* In *Betts* v. *Clifford* (Warwick Lent Assizes, 1858) the late Lord Campbell stated, in answer to a question, that a *scientific witness* was not bound to attend upon being served with a subpœna, and that he ought not to be subpœnaed. If the witness knew any question of *fact* he might be compelled to attend, but he ould not be compelled to give his attendance to speak to matters of *opinion.*

In *Rich* v. *Pierpoint*, an action for malapraxis, Dr. Lee was summoned gainst his will to give evidence on the part of the plaintiff. He stated that n the evening before the trial a solicitor called on him and left a subpœna ith him. Dr. Lee would not hear any account of the case which the olicitor proposed to give, and expressed his resolution to have nothing to o with the trial. The solicitor informed him that he would be required to ay the usual penalty if he did not attend. He went down to Kingston, and as warned not to leave the Court until the trial was over. He heard the idence on the part of the plaintiff, and upon this and the medical evidence e gave his opinion—not much in favour of the party who summoned him, nd not much against him. Dr. Lee considered that he could not avoid tending the trial under these circumstances. (‘Medical Times and Gazette,’ pril 12, 1862, p. 389.)

In the case of *Webb* v. *Page* (‘Carrington and Kirwan's Reports,’ p. 23) e late Mr. Justice Maule ruled as follows :—‘There is a distinction,’ said his rdship, ‘between the case of a man who sees a fact and is called to prove it a Court of justice, and that of a man who is selected by a party to give his inion on a matter on which he is peculiarly conversant from the nature of s employment in life. The former is bound, as a matter of public duty, to eak to *a fact* which happens to have fallen within his own knowledge— thout such testimony the course of justice must be stopped. *The latter is der no such obligation*; there is no such necessity for his evidence, and party who selects him must pay him.’ In the case referred to by Mr. stice Maule, a skilled witness had been subpœnaed, but refused to give dence unless first paid for his services and loss of time (‘Medical Times and zette,’ April 26, 1862, p. 432). A barrister, who quotes this ruling, goes to say : ‘There is one reason why I should not advise any person in the sition of a skilled witness totally to disregard a subpœna. It is quite clear that should such a person fail to attend a trial no attachment could issue, even if he were called as is usual upon the subpœna, because the party subpœnaing him could not make the requisite affidavits that he was damnified by the witness's absence and in what respect. But such party might bring an action for damages; and although he would recover none, he might not only worry, but might even put the defendant to a considerable expense, as taxed costs by no means include the entire costs in such cases. Although, therefore, I could not advise a total neglect of the subpœna, the safest course would be to obey it, and demand expenses before giving evidence. Such expenses would be only those allowed for a professional witness (not special fees); but if the person so subpœnaed were willing to run the risk of an action, he might safely absent himself without any fear of an attachment from the Court for contempt.'

With regard to the question whether a skilled witness would be permitted to demand a high fee for his attendance under such circumstances, the writer adds: 'To permit him legally to demand a high fee would perhaps look somewhat like legally countenancing a bribe.' At all events there is no such legal recognition.

The question may not be one of fees, but of obedience to a simple order to attend and give evidence on matters of *opinion* irrespective of scientific facts. In a case before Vice-Chancellor Wood (*Simpson* v. *Halliday*, 1864), I was required to attend on a subpœna as a skilled witness, to give evidence of *opinion* in reference to the alleged infringement of a patent. The defendant, who summoned me, did not make it in any way a question of fees; but being wholly unacquainted with the facts of the case, I did not feel in a position at a short notice to appear as a witness for parties of whom I knew nothing. I obeyed the subpœna, as the disobedience of it might have been, in the present uncertain state of the law, a contempt of Court; and after giving my evidence, I requested his Honour to state for future guidance whether a skilled witness was compelled to attend under such circumstances as those in which I had attended. I referred him at the same time to the decision of Lord Campbell in *Betts* v. *Clifford*. The Vice-Chancellor said that a Court of Law never gave an opinion on a speculative question, and there the matter ended.

It would seem therefore that a skilled witness, who is not acquainted with *any of the facts* in a case, may be compelled by a subpœna to attend and give evidence on a matter involving scientific opinion alone. Some months before this occurrence, I had given evidence in a similar case, and the defendant Halliday, seeing that my opinion in that case was favourable to his views exercised a right to impound my services on his behalf. When some portion of the public press undertake to censure experts for acting as hired witnesses, i may be as well to remember that they may be sometimes unwillingly forced into Court by subpœnas which they dare not disobey.

Lord Campbell's dictum in reference to the distinction between fact and opinion confers no practical benefit on witnesses. It is at all times difficult in science, and in the medical sciences particularly, to separate them; and if man appears to testify to a medical or scientific fact, he cannot avoid givin an opinion arising out of the fact. In a recent action against a druggist for mistake in compounding medicine, an attempt was made to procure my *opinion* as a skilled witness at the trial, by reason of *facts* obtained from the report of a chemical analysis, the object of which was at the time entirely concealed from me. The suit was fortunately compromised, and my attendance was not necessary; but such a case should convey a caution to chemical experts. They may be employed secretly and under untrue statements to make analyses; these become *facts* on which they may be summoned like ordinary witnesses to give *opinions* as skilled witnesses, while the payment of the usual fee for a skilled witness is evaded.

A medical man may be placed in the disagreeable position of receiving separate subpœnas, to attend trials at different Assizes which are held at or about the same time. An obedience to both of them is clearly impossible—one at least must be sacrificed to the other. I have been placed in this position on three occasions, and on one of these I was called from a civil trial which had commenced in the Assize Court at Durham, to a criminal trial which was fixed to take place on the same day at Lincoln. The civil case was postponed, and I had so far the benefit of the opinion of one of the most learned judges on the Bench, that in all cases in which there were served separate subpœnas fixing trials for the same time, the civil should give way to the criminal case. The former can be postponed, the latter cannot. But if the subpœnas are for wo criminal cases, the course of a witness should be to attend to that in which he subpœna was first served upon him.

Medical Witnesses.—Assuming that the medical man has obeyed the subpœna, he will now be required to attend before the Court, and to state, in he face of adverse counsel, the opinions which he has formed from the medical acts of the case, as well as the grounds for these opinions. He will then for he first time undergo the ordeal of a public examination.

Some medico-legal writers have considered it necessary to lay down rules especting the manner in which a medical witness should give his evidence; ow he is to act on a cross-examination, and in what way he is to recover imself on re-examination. Any advice upon this head appears to me to be uite superfluous; since experience shows that these rules, like those given to revent drowning, are invariably forgotten at the very moment when the ndividual is in the situation in which it is supposed he most requires them. A man who goes to testify to the truth to the best of his ability should ear in mind two points. 1. That he should be well prepared on all parts of he subject on which he is about to give evidence. Let him remember on hese occasions the advice contained in the Latin motto, *ne tentes aut perfice.* That his demeanour should be that of an educated man, and suited o the serious occasion on which he appears, even although he may feel mself provoked or irritated by the course of examination adopted. A edical witness must not show a testy disposition in having his professional ualifications, his experience, his means of knowledge, or the grounds for his pinions very closely investigated: he should rather prepare himself to meet ith good humour the attempts of an adverse counsel to involve him in ontradiction, and show by his answers that he has only a desire to state the truth. Law and custom have long established that a barrister, in defending a prisoner charged with murder, has a right to make use of all fair and even what may appear to the witness unfair means for the defence. Nothing can tend more to lower a witness in the opinion of the Court and jury, or diminish the value of his evidence, than the manifestation of a disposition to deal with his examiner as if he were a personal enemy, to evade the questions put, or to answer them with flippancy or anger. All such exhibitions invariably end in the discomfiture of the witness. It has been suggested that medical men on these occasions might take a lesson from lawyers, and observe how little they allow forensic differences, which they put on with their professional costume, to influence them in their intercourse with each other, or with an adverse judge or jury.

Medical men have complained, and on many occasions justly, of the *license of counsel.* On this subject it may be well to consider what has been said by one of the highest authorities on the Bench, Chief Justice Erle:—'The law trusts the advocate with a privilege in respect to the liberty of speech which is in practice bounded only by his own sense of duty; and he may have to speak upon subjects concerning the deepest interests of social life, and the innermost feelings of the soul. The law also trusts him with a power of insisting upon answers to the most painful questioning, and this power again is in practice only controlled by his own view of the interests of truth.' (Judgment in *Kennedy* v. *Broun*, 1862.) Thus it will be seen that almost unlimited powers of interrogation are entrusted to counsel by the law, and it is a serious question whether the unrestricted use (which it has been justly remarked means only the frequent abuse) of these enormous powers is necessary or even favourable to the admininstration of justice.

One of the most severe reprimands on this abuse came from the same learned judge in a case which was before him in 1857; it was addressed to a learned serjeant now deceased, and was to this effect,—A question had been put throwing on the witness an imputation for which there was really no foundation. The learned judge then said: 'The freedom of question allowed to the bar was a public nuisance, and the barrister who made such an imputation ought to be prosecuted. If a question had relation to the truth, he was most anxious it should be put; but to cast haphazard imputations at the suggestion of a person (an attorney) who might have no scruples as to what he did, was a degree of mischief that made him wish that a party should be prosecuted. He begged leave to say that in his experience he had seen counsel so abuse their privilege, that he had cordially wished a power could be instituted that they might be prosecuted for a misdemeanour.' It is the general practice to say that the obnoxious questions are in the instructions but a barrister can always exercise a power of putting or not putting a question which may be found there. By putting it he clearly adopts it, and frequently to the great damage of his own case. This is at present the only check upon the practice, for learned judges seldom interfere unless appealed to by the witness.

Some medical men have claimed a privilege not to answer certain question which are put to them, on the ground that the matters have come to thei knowledge through private and confidential communications with their patients. It is right to state at once that the law concedes no special privilege of this nature to members of the medical profession. No man is bound to reply to any question if the answer would tend in any way to incriminate himself—for no man is compellable to be a witness against himself. With this exception all questions must be answered, provided they are relevant to the case, and their irrelevancy is a matter for the consideration of the learned judge who presides.

A witness must remember therefore that there are *no medical secrets.* In the case of the *Duchess of Kingston* this privilege of withholding statements was claimed by a medical witness but denied. In a case in which a female was indicted for the murder of her infant, a surgeon was called to prove certain confessions made to him by the woman during his attendance. He objected, on the ground that he was then attending her as a private patient. The learned judge (Park, J.) said this was not a sufficient reason to prevent a disclosure for the purposes of justice, and he was ordered to answer the questions. (Beck's 'Med. Jurisprudence,' vol. ii. p. 922). Any statements therefore which are made to physicians or surgeons while attending persons in a private capacity, although they are not to be volunteered in evidence, must be given in answer to questions whatever consequences may ensue. Cases of poisoning and wounding, duelling, as well as cases which involve questions of divorce or the legitimacy of offspring, may be materially affected by the answers of the medical man on matters which have been the subject of private communications.

Examination-in-chief.—The ordinary course of proceeding in a criminal case is thus concisely stated by Mr. Fitzjames Stephen ('Criminal Law of England,' pp. 168, 282). After opening the case the counsel for the Crown calls the witnesses, and examines them according to the rules of evidence—that is, he brings out by questions *which do not suggest their answers*, the facts relevant to the issue to be tried which are within his personal knowledge. Those questions which suggest the answers are called 'leading' questions. With one exception it is not the practice to allow these to be put in this part of the examination. The exception according to Mr. Stephen is: 'When the judge is satisfied, either by a witness's demeanour or by contradictions between the evidence and the depositions, that he is trying to keep back the truth and favour the prisoner, he may in his discretion allow the counsel for the Crown to ask leading questions and, as the phrase is, to treat the witness as hostile.' When the examination-in-chief has been given, the next step is the cross-examination.

Cross-examination.—In this, the second stage, the counsel for the prisoner extracts from the medical witness, by questions *which may suggest the answer in the strongest form*, any facts that may appear to be favourable to his client, and which he believes to be within the witness's knowledge. Leading questions are not only allowable in this part of the examination, but, according to good authority, a counsel for the defence can hardly lead too much. The theory of the law is that the witness is unfavourable to the prisoner and has come to bear evidence against him. The more he has shown himself by conduct or conversation a partisan in the case, the more severely will he be treated. Anything which he may have said in the hearing of others, or published in journals or even written in private letters (if the contents transpire) in reference to the case or the guilt of the prisoner, is now brought to light, although he may have supposed that what he did say was in perfect confidence. It is at this stage of the case that any exaggerations which may have been most favourably received by the counsel for the prosecution are reduced to their true proportions. Any bias by which the mind of a witness may have been influenced, or any imperfection or confusion of memory as to facts, is here brought out. (Stephen, p. 177.) It is in this part of his examination that the witness will be closely questioned as to his qualifications, the time during which he has been engaged in practice, the accuracy of his judgment, his general professional knowledge, and his special experience in reference to the matter in issue, the number of cases he has seen, &c. Straightforward answers should be given to all these questions. No harm can be done to the witness by the answers unless they are given evasively, since it is not to be supposed that the witness wishes to represent himself differently from what he is. If he does make the attempt, he will assuredly fail. The most striking distinction between the examination-in-chief and cross-examination is in reference to leading questions. It rests upon the assumption that there is a danger that a witness will say whatever is suggested to him by the one side, and conceal everything that is not extorted from him on the other.

It need scarcely be observed that witnesses whose evidence is of little importance in the case are rarely cross-examined. This, however, is reserved in its most stringent form for those whose facts and opinions are likely to affect the fate of a prisoner in a criminal trial.

In dealing with a skilled witness whose evidence may be of importance, the questions in cross-examination are usually put by the counsel for the prisoner with great caution, or the answers brought out may be more adverse to his own case than those elicited in the examination-in-chief.

Re-examination.—The cross-examination is usually followed by a re-examination on the part of the counsel for the Crown, or of the counsel by whom the witness has been called. The object of this is to clear up or explain any portion of the evidence which may have been rendered obscure or doubtful by the cross-examination. It is sometimes unnecessary to put a question, and if the witness has given his evidence consistently and fairly no questions may be asked. As a rule the re-examination must be confined to those matters which have arisen out of the cross-examination. Any questions upon new subjects may render a further cross-examination on them necessary. In reference to *facts*, a medical witness must bear in mind that he should not allow his testimony to be influenced by the consequences which may follow from his statement of them, or their probable effect on any case which is under trial. In reference to *opinions*, their possible influence on the fate of a prisoner should inspire caution in forming them; but when once formed they should be honestly and candidly stated without reference to consequences. It will be well to remember, in regard to each stage of the examination, what a great medical authority has said :—'To make a show and appear learned and ingenious in natural knowledge may flatter vanity. To know facts, to separate them from supposition, to arrange and connect them, to make them plain to ordinary capacities, and above all to point out their useful applications, should be the chief object of ambition.' (William Hunter.)

Quotations from books.—It is a not unfrequent custom with counsel to refer to medical works during the examination of a witness. He is expected to have a fair knowledge of the writings of professional men in reference to the subject of inquiry. The authority is mentioned, the passage is quoted, and the witness may be then asked whether he agrees with the views of the author or whether he differs, and if so, his reasons. In cases connected with medical treatment, the views of the profession are and have been so various, that a barrister would have no great difficulty in finding some book to oppose to the opinions of a witness. Standard works of recent date are so well known to the profession that there are few medical men engaged in practice who are not acquainted with and able to explain the views of the writers and how far they agree or conflict with his own. The witness must be on his guard that the quotation is fairly made, and that it is properly taken with the context, or he may unexpectedly find himself involved in a difficulty. On one occasion I found that a learned gentleman stopped in his quotation at a comma, and on another occasion the quotation ended at a colon—the remainder of the sentence in each case materially weakening the inference which it was intended to draw with the apparent sanction of the witness!

Presence in Court.—In England medical and scientific witnesses, except nder special circumstances, are allowed to be present in Court and hear the hole of the evidence in the case. This is in some instances absolutely necesary if the Court requires medical opinions, for unless the witnesses are fully cquainted with the facts they can give no opinions, and they can only become lly acquainted with the facts by being allowed to be present and hearing the vidence in court. If excluded, the judge or counsel will be compelled to ead to the witness notes of the evidence before an opinion can be given, and may then appear that some small point which counsel did not think of nportance is omitted: this if known to the witness might, however, materially ffect his opinion. A failure of justice is likely to occur when medical witesses are excluded, and it is generally where there is no defence or a false fence that the right of excluding them is exercised. The rule in Scotland different; medical witnesses are there rigorously excluded from Court until er they have delivered their evidence.

The examination of the witnesses for the Crown is followed by the defence the prisoner, either in person or by his counsel, who acts throughout the rt of an advocate, simply securing for his client every advantage the facts the law may afford him. In other words, he sees that his client is strictly ed according to law, and not condemned contrary to law.

A key to some of the difficulties which medical witnesses must be prepared encounter will be found in the exposition given by Mr. Stephen of the tacit rules which regulate the duties of counsel for the prosecution and defence:—'In practice it is universally admitted that the counsel for the prosecution is morally and professionally bound always to keep in sight the ultimate object—namely, the discovery of truth; whereas no such obligation is laid upon the prisoner and those who represent him, because it is too much to expect of human nature that they should discharge it, and it is better not to impose an obligation which is sure to be systematically violated. Both sides, on the other hand, are bound in the strongest way *not to do anything to propagate falsehood.* The counsel for the Crown is bound not to suppress any fact within his knowledge favourable to the prisoner; and, on the other hand, the counsel for the prisoner is bound not to bring to light facts within his knowledge unfavourable to the prisoner. 'The counsel for the Crown may not use arguments to prove the guilt of the prisoner which he does not himself believe to be just, and he is bound to warn the jury of objections which may diminish the weight of his arguments: in short, as far as regards the evidence which he brings forward, his speech should as much as possible resemble the summing-up of the judge. He should contend not for the success of his cause at all events, but for the full recognition by the judge and jury of that side of the truth which makes in favour of it. On the other hand, the counsel for the prisoner may use arguments which he *does not believe to be just.* It is the business of the jury, after hearing the judge, to say whether they are or are not just.' (Op. cit. pp. 160 and 168.) The last remark shows what appears to be a serious defect in the administration of the criminal law. While in a case of misdemeanour a prisoner may be tried by a special jury, in a case of felony, involving an analysis of important questions of medical science in reference to murder or manslaughter, the trial takes place before a common and comparatively ignorant jury. Such a jury is hardly in a position to cope with an ingenious counsel, who has it in his power to misrepresent and distort medical facts and opinions in any manner that he pleases. The chapters on Infanticide will furnish numerous illustrations of the measure which counsel take of the intellectual capacity of common juries. The defences made are frequently such as no man would venture to place before a jury of educated men. These 'powerful' or 'forcible' addresses, as they are termed by the press, full of burning eloquence and impassioned logic, have frequently withdrawn the attention of the jury from the real facts, and have procured verdicts of acquittal contrary to the evidence and all the medical circumstances of the case.

Another observation made by Mr. Stephen more nearly concerns the medical witness:—'There are many obligations which affect each side equally. Neither is at liberty to attempt to browbeat, intimidate, or confuse a witness, although they may expose any real confusion which exists in his mind, or test, by the strictest cross-examination, the accuracy of his statements. Neither is at liberty wilfully to misunderstand a witness, or to *misstate, in his address to the jury,* the effect of what he has said, either by distortion o suppression. The neglect or observation of these and other rules of the same kind practically establishes a wide distinction, and one which is easily recognized, between those who exercise a noble profession and those who disgrac it.' (Op. cit. p. 168.)

The treatment of a medical witness, in passing through the ordeal of an examination at a criminal trial, will depend therefore very much upon the class of counsel who is opposed to him. Assuming that he is properly prepared for the discharge of his duties, and that the questions put to him are answered fairly and truly, according to his knowledge and experience, without exaggeration or concealment, he has no reason to fear any attempt at intimidation. Barristers, for the most part, know that by this line of conduct they lose more with the jury than they gain by the attempt to confuse the witness; and as their ultimate and sole object is a favourable verdict, they will generally avoid conduct which must necessarily place this verdict in jeopardy.

The normal barrister, as depicted by Mr. Fitzjames Stephen, is not at liberty, in his address to the jury, to misrepresent, either by distortion or suppression, the medical facts or opinions given in a case. According to my experience, however, misrepresentation is a not unfrequent practice, and one of which medical witnesses have very strong reason to complain. Whether such misstatements are wilful or not it may be difficult to determine, but their effect on the jury is well known to those who employ them, and they frequently escape the observation of the counsel on the other side, and even of the learned judge, unless he happens to be well versed in medical subjects. It is also worthy of remark, that if a misstatement is thus made, it is by a remarkable coincidence always in favour of the view of the counsel who makes it, when a proper examination of his notes would, in general, show him that he was wrong.

Then as to the question of intimidation, this is sometimes carried very far. On a trial for murder by poisoning, I have heard a respectable country practitioner, who had given his evidence for the Crown in a fair and proper manner, thus addressed in cross-examination by a learned counsel now deceased :—'On your oath, sir, and in the face of the whole profession, will you venture to persist in that statement?' &c. It may be that criminal cases fall more into the hands of the second class of barristers to whom Mr. Stephen alludes—namely, those who disgrace a noble profession. But it is a widely-spread opinion in the medical profession, that this style of examining educated men, who are perhaps compelled most unwillingly to appear on a subpœna to testify to facts, is certainly not adapted to elicit the truth, but rather to favour the escape of criminals and give impunity to crime.

It may be fairly admitted that a man who puts himself forward as a witness, and attempts to elucidate what he only succeeds in rendering more obscure, should receive no favour at the hands of the bar. Dr. Elwell, a member of the egal as well as of the medical profession, observes that—'No witness is ever compelled to appear and testify to what *he does not know*. He may be compelled to attend in Court in obedience to a subpœna; but if he attempts to estify upon a subject requiring *opinions* upon which he has no well-settled r well-defined ideas, it is his own fault, and he alone is to blame; for no one ut himself can know so well as he, until he has exposed himself, how unfit e is for the occasion.' (Medico-legal Treatise on 'Malpractice and Medical Evidence,' by J. J. Elwell, M.D., Member of the Cleveland Bar, New York, 1860, p. 302.) But let us take the case of a practitioner who, in a country district, has gone through twenty years of practice with honour and credit in his neighbourhood, and who is suddenly called to a case in which a man is found dead from a wound in his throat. Under the Medical Witnesses' Act he is compelled to make an examination of the body for a Coroner's inquest. At a great loss of time, and for no adequate remuneration, he attends the inquest and gives his evidence; he is bound over, *nolens volens*, to appear for the first time as a witness at a criminal trial, and to testify, 1st, to the throat being cut, and 2ndly, to give his opinion to the Court on the cause of death, and whether the wound was inflicted by the deceased on himself, or by another person. A medical man who limited himself to the statement of the bare fact that the deceased's throat was cut need not appear at all, for this evidence might be supplied by a constable or policeman; but the law presumes from his profession, that the medical man made a proper examination of the wound, with a view to determine, to the best of his ability, whether it was the cause of death, and whether it was or was not self-inflicted. It is difficult to understand how a medical man, although before this occurrence he may never have seen a case of cut-throat, could excuse himself from giving answers to these questions, both of which involve purely matters of *opinion*. If he excused himself altogether from giving answers, there would be a failure of justice, and no conviction for such a common form of murder could ever take place. If, on the other hand, he answers these questions to the best of his ability, he may reasonably complain that while thus compelled to appear as a witness to testify to what he does know, his evidence should, by rules of law, be made the subject of abuse and ridicule before his neighbours, when he expresses his *opinion* from the facts; and that the counsel who examines him legally possesses an unlimited power of misrepresenting his views. A medical man is certainly not benefited by being described as an ignoramus or a blunderer in his profession, whom no one ought to trust. The truth is, in medical evidence facts and opinions cannot be separated; and if medical practitioners were restricted in their evidence only to those facts which they observed in a case in which no other professional man saw the person living or dead, it is difficult to understand how crime could be detected and punished. These remarks of course do not apply to cases in which the opinions of medical experts can be taken. Here it would be desirable that one who has not had experience on the subject should avoid giving any opinion; he might simply state the facts, and decline for want of experience to give an opinion on the conclusions to which they lead. In pursuing any other course, he will find that the whole weight of the cross-examination will fall upon him.

There are other remarks on this subject made by Dr. Elwell, which those who are compelled to attend as witnesses in a Court of Law will do well to bear in mind:—'However anxious an incompetent witness may be to appear learned, and however hard he may labour to show it, he will ever find it a difficult business to make the Court and counsel believe that he is really so. To appear really learned, he must be able to make the subject on which he gives an opinion *clear*, and to give *satisfactory reasons* for this opinion. He must be not only a thinker, but must satisfy others that he is master of the subject. Take almost any one of the important scientific questions upon which a professional witness is called to pass an opinion, and unless he has *looked at the subject before with a purpose to understand it*—comprehending its extent, weight, and relations—he will find it to have suddenly assumed an importance he had not suspected, just at the time when the discovery will add to his confusion. It is better to make this discovery in the quiet stillness and security of solitude, than under the eye of a judge and the severe scrutiny of counsel. A man, whether learned or not—whether in court or out of court—will talk clearly upon a subject he well understands, whether it is scientific or otherwise; but *unless it is clear in his own mind his account of it will be confused and unsatisfactory*.' (Op. cit. p. 303.) This is undoubtedly the test to which every man should rigorously submit himself before entering the witness-box. The case should be viewed in all possible aspects, and if an opinion has been formed, it should be dealt with and criticised as if it were that of an adversary. As in controversy, a disputant should put himself as much as possible into the position of his antagonist, and see the question from his point of view. In this kind of self-examination it may be well to remember two points—1st, that there is no opinion so certain as that the human mind, if left to itself, will not infallibly raise a difference of opinion upon it; and 2ndly, that a man is never so near an error as when he claims a complete immunity from error.

Rules for the delivery of Evidence.—There are a few rules bearing upon medical evidence which, if observed, may save the witness from interruption or reproof and place him in a favourable position with the Court:—

1. The questions put on either side should receive *direct* answers, and the manner of the witness should not be perceptibly different whether he is replyto a question put by the counsel for the prosecution or for the defence.

For reasons elsewhere assigned (p. xxxix), most of the questions put by counsel in cross-examination will admit of an answer 'yes' or 'no'. If, from the ingenious or casuistical mode in which the question is framed, the witness should feel that the simple affirmative or negative might mislead the Court, then, after giving the answer, he can appeal to the judge to allow him to qualify it, or add to it any matter within *his own knowledge* and which is at the same time relevant to the case. The witness must remember that he takes an oath to state the truth, *the whole truth*, and nothing but the truth. On the other hand, while the counsel for the defence is bound not to introduce falsehood, his object is *not* the discovery or development of truth. Unless the witness is on his guard, he may find that his affirmatives and negatives may be worked into a shape representing the reverse of what he intended, when the learned counsel who has cross-examined him addresses the jury.

Some counsel adopt the ingenious plan of compressing two or three questions into one. A witness unthinkingly answers the last, or that which most fixes his attention. The same answer may not be strictly applicable to all, but the witness may find, when too late, that it is made so in the defence. In this case he should ask for a severance of the questions and give separate replies.

Direct answers are necessary, because it is only by them that the case can be brought clearly before the Court and jury in all its details. Medical witnesses sometimes forget this, and fall into answers to questions floating in their own minds, or which they think are likely to be put to them. They are also sometimes disposed to anticipate many questions by one general answer. This simply creates confusion, and the witness will be told by counsel to keep to the question, and that he is coming to the other matters presently.

In a case involving a question of compensation for personal injury as a result of a railway accident, tried at the Autumn Assizes of 1865, medical witnesses were called on both sides. The reporter of the trial observes, in reference to the evidence of one of the medical witnesses for the plaintiff: 'In the course of a long cross-examination, this witness appeared to avoid giving "direct" answers to the questions put to him, and to affect to misunderstand them, to such an extent as to draw from his lordship the remark, "Do pray, Dr. ——, be a little more candid."' From some other judges a witness thus acting would have met with a much more severe rebuke. A witness should remember, at all times, that he takes an oath to state the *whole* truth.

Care should be taken by the medical witness not to argue with the learned counsel. Argument is not evidence, and the entering into it disturbs the order of the proceedings. Arguments between counsel and witnesses, and even between medical witnesses themselves, are freely allowed in the French Courts, but in England such a practice is not recognized. The mode in which questions are put by counsel in cross-examination sometimes tends to the introduction of argument, but the witness should avoid the temptation to enter into it. What he says under such circumstances is not evidence, except in the form of answers to questions, and he is there only for the purpose of stating what is relevant to the case.

There is a difference between evidence and testimony. A medical witness sometimes gives much in the form of testimony which amounts to very little as evidence. When he does not attend to the questions, he testifies to a variety of subjects which have no bearing on the case, and do not constitute evidence. The decision on what is and what is not evidence lies with the judge.

2. The replies should be concise, distinct and audible, and, except where explanation may be necessary, they should be confined strictly to the terms of the question. The learned judge who tries the case, generally takes full notes of the medical evidence—hence the necessity for a slow and distinct delivery of the evidence.

Some witnesses have a singular habit of not answering the question which is asked, but one which is not asked. Others give an answer in such a voluble form, in the shape of a small speech or lecture, that there is great difficulty in reducing it to its proper proportions. A witness who is so profuse of information generally supplies abundant matter for a long and troublesome cross-examination. He voluntarily places himself on the *mensa lanionia.*

It has been a question whether a witness should volunteer evidence, assuming that the examination-in-chief and cross-examination have not brought out all that he knows of the case. If that which he has to state is some matter of fact within his own knowledge, or an opinion based on facts within his knowledge, he will be allowed, on application to the judge, to make the statement in spite of the efforts of counsel on either side to shut it out.

It is scarcely necessary to observe, that the language in which the answers are returned should neither be flippant nor metaphorical. Counsel who are unacquainted with medical terms frequently misapply them, or use them in a wrong sense. There are few barristers who are aware that the term 'symptom' is confined to the living body, and 'appearance' to the dead; and the witness may thus find himself questioned on the 'appearances' when he first saw the patient, or the 'symptoms' which he observed on the post-mortem examination of the stomach and bowels. On a trial for murder, in which one of the questions at issue was whether dysentery or poison was the cause of death, the learned counsel puzzled one of the medical witnesses by asking him whether during his attendance he found any traces of '*dysuria*' n the fæces! There is no doubt he intended a state of the fæces like that met with in dysentery, but the professional term employed by him signified a difficulty in passing urine.' A judicious witness will avoid anything like a riumph over his examiner under such circumstances, and simply put him ight.

3. Answers to questions should be neither ambiguous, undecided, nor vasive. An ambiguous answer necessarily leaves the witness's meaning oubtful, and calls for an explanation. An undecided answer—indicated by the ords 'I believe,' or 'I think,' or 'It might be,'—is not sufficient for evidence. id the wound cause death? Was death caused by loss of blood or poison? , by a proper consideration of all the medical facts, the witness has come a conclusion on the subject, his answer should be expressed in plain and ecided language, either in the affirmative or negative. A man who has rmed no conclusion is not in a position to give evidence. No opinion ould be given for which the witness is not prepared to assign reasons, and, cept by permission of the Court, no medical opinion should be expressed on ts or circumstances observed by others. A hesitating witness will be met th the question, Have you any doubt about it? or, Was it so or not?—to ich a reply in the affirmative or negative must be given. If the witness rly entertains doubts about the matter at issue, it is his duty to express m, and not allow them to be extorted from him piecemeal by a series of estions.

Chemical witnesses have occasionally certified to the discovery of 'imper- ptible,' 'unmistakable,' or 'undoubted' traces of poison in the liver, &c. ch terms naturally convey to the shrewd mind of the examiner that witness has some lurking doubt or suspicion of mistake in his mind, for t of which we are sure requires no such terms to express our meaning. If on has been discovered, the statement of the fact is sufficient.

. The replies should be made in simple language, free from technicality. ne remarks have been elsewhere made in reference to the use of technical terms in drawing up medico-legal reports (p. xxv). If medical men could be made aware of the ridicule which they thus bring on their evidence, otherwise good, they would at once strive to dispense with such language. A witness is perhaps unconsciously led to speak as if he were addressing a medical assembly, instead of plain men like the members of a common jury who are wholly ignorant of the meaning of medical terms, and barristers who are but imperfectly acquainted with them. Thus a medical man will speak of the 'integuments of the cranium' instead of the 'skin of the head,' and a common cut is invariably described as an 'incision.' At p. 384 the reader will find a most erudite and elaborate description of a 'black eye,' which for a time bewildered the Court, until it was resolved by the learned judge into these two simple words, the meaning of which every one in Court could understand. In a case of child-murder, a medical witness who was asked to state the cause of death said that it was owing to 'atelectasis and general engorgement of the pulmonary tissue.' This is not science, but pedantry; and if such language is employed by a witness with a view of impressing the Court with some idea of his learning, it wholly fails of its effect. Barristers and reporters put down their pens in despair, and the time of the Court is wasted until the witness has condescended to translate his ideas into ordinary language.

Medical Experts.—In cases of a complicated nature and involving important interests, it is customary to call in medical or scientific experts, who, by reason of their special experience in certain branches of the profession, are presumed to be able to guide the Court to a proper understanding of the facts of the case. In questions of legitimacy or divorce, obstetricians of high standing are consulted on both sides; in questions affecting the sanity of persons, those who have acquired a reputation in the treatment or observation of the insane are selected; in the various obscure injuries resulting from railway accidents, surgeons of repute,—and in questions of life-insurance, physicians of high standing are summoned as experts to give the results of their experience. There are many of these cases, including some in criminal law, which could not possibly be settled without this collateral aid—the questions at issue not being based on matters of fact occurring within the ordinary range of practice, so much as on an enlarged experience in a particular department. There is, however, a strong public feeling against the admission of the testimony of experts. One able writer remarks:—'It is impossible to shut out such evidence altogether, but there is nothing which brings more discredit upon the administratio of justice. There is one consequence of its admission which is common to al cases in which it occurs: it is, that no difficulty has ever been found i obtaining any amount of evidence of this description, on either side of an point in issue. There is a contest as to whether a vitriol or a gas manufactor is a nuisance. Twenty chemists of fair character and scientific acquiremen come forward to swear that the effluvia evolved by these processes are producing the most deadly fevers, and twenty others equally eminent will giv just as positive testimony that the gases are absolutely wholesome, and rath fattening than otherwise. These things are of everyday experience.'

It will frequently be the duty of a medical expert, in civil as well as in criminal cases and in all actions for malapraxis, to pass an opinion on the practice of another professional man. On such occasions, while there should be no suppression of the truth, a witness is bound, in answering questions put to him by counsel, to state his opinion and the grounds on which it is based clearly and distinctly. It may be hard to condemn a brother-practitioner, but it would be still harder to ignore the public interest, and condemn ourselves and our profession by concealing that which we know to be true, or by suppressing what we honestly believe. There is no etiquette in the profession which demands such a sacrifice of principle as this conduct involves. A medical witness is not bound to be forward in pointing out and suggesting defects, or in endeavouring to lower another practitioner in the opinion of the public; but nothing should be concealed which is relevant to the elucidation of the case in issue. The golden rule, 'Do unto others as you would that they should do unto you,' should be strictly observed on these occasions.

Certain lunacy cases of recent occurrence, and cases of compensation for bodily injury by railway accidents, have drawn particular attention to the testimony of experts. Lord Westbury, in referring to experts in lunacy in the *Windham* case, remarked that they came forward to swear away the sanity of persons, and when their reasons were examined it was found that persons sserted to be insane could not answer questions which some of the witnesses hemselves were unable to answer. 'The absence of explicit statement,' said Lord Westbury, 'was abundantly made up by a flow of hard names, which o doubt had great weight with the jury. "I should call unsoundness of mind a mixture of chronic mania and *dementia*," said one doctor; "speaking n popular language, I should call it a mixture of mania and fatuity occurring n a person once having a sane understanding." Another learned physician xamined the same lady, no doubt with great cleverness, and thought he ould try her knowledge of law. He therefore asked her several questions bout the Constitution, but when similar questions were addressed to him by ounsel he himself betrayed considerable uncertainty and hesitation. In an xamination of an alleged lunatic in another of these cases, she was asked how uch 100*l*. a-year would give per week; she was not able to tell, and this as relied on as a proof of her insanity; but upon cross-examination of e medical man who was giving evidence of her lunacy, he was asked hether he himself could tell how much per week 100*l*. a-year would give: e hesitated. He was then asked whether he did not know or declined to ll; his reply was that he declined to tell.'

It cannot be denied that experts have frequently introduced into their idence speculative fancies and idle theories, not warranted by a proper duction from the facts; but it is quite clear that in all trials requiring ecial knowledge, if justice is to be administered, the Court must be assisted those who possess that knowledge. I have elsewhere suggested the cause of e evil, and what I believe would prove a remedy (pp. 564 and 1072). The use of the evil is that the solicitors on each side are allowed to search the hole profession, until they can find one or more persons ready to adopt their respective views; and when once in Court, provided a man can call himself ‘doctor,’ his qualifications and experience sometimes escape a rigid scrutiny. Persons have thrust themselves or been thrust into cases as experts without any pretensions to such a title, either by their professional standing or experience. A man who may have been engaged only in the ordinary routine of medical practice, and who may have had no special experience on the subject on which an opinion is required, will be described by his counsel ‘as a most eminent member of the profession, on whose opinion the jury are as much entitled to rely as on that of the very respectable gentleman called on the other side,’ &c. The nomination of experts as witnesses by the judge who tries a case, or by the Lord Chancellor in his department, would do away with most of the objections which now tell with so much force against the evidence of experts. As long as they can be retained by either party—and the profession is large enough to furnish a great variety of experts—so long will the objections to the present system continue, and the good be confounded with the bad. But even men of professional skill and position sometimes give cause for censure. An expert is usually called to give an opinion on a certain state of facts laid before the Court in the evidence of other witnesses: thus certain appearances may be described as having been seen in the stomach or brain, and he may be asked to state the conclusions to which such appearances lead. A medical practitioner may describe accurately what he sees, but may not have sufficient experience to draw a correct conclusion. In this case an expert may differ from him and totally alter the bearing of the case. So a man may describe certain symptoms which an expert may say are or are not consistent with poisoning, but he must take care that he does not alter or distort the facts deposed to by other witnesses, in order to fit into the case his own theories or opinions. The alteration of facts to suit special views is by no means unfrequent, and an expert who thus deliberately mangles the evidence of others cannot escape the charge of being a partisan or an advocate in the case—a character wholly inconsistent with that of a witness who should aim to be in all things impartial. A glaring instance of this kind occurred at the Guildford Summer Assizes of 1862, in an action against a railway company for damages for personal injury. The condition of the plaintiff was accurately described by his medical attendant. Some eminent surgeons who had examined him were called as experts to depose to his present and probably future condition. Other equally eminent surgeons were called as experts on the part of the Company, and they differed (as well they might) on the speculative question when the man was likely to recover entirely from the effects of this accident. One of the most distinguished surgical experts for the defence, however, began by saying that plaintiff had only sustained a ‘considerable shake;’ but shakes are not commonly recognized as surgical accidents, and the surgeon on the other side had described this, from actual examination, as a ‘concussion of the spine.’ But the witness continued—‘And as to what was said of congestion of the fibrous tissue, it was mere phraseology not indicating actual facts.’

The learned judge who tried the case observed that he could hardly take that as evidence. 'The *witness must state facts, or his opinion from facts.*' The witness then *disputed the facts*, but the learned judge told him that he had no right to do so, and that he must *give his opinion on the facts as proved.*

In these few words are defined the whole of the duties of an expert who presents himself as a witness. The above example shows clearly what ought to be avoided, and it corroborates an observation elsewhere made (p. xix.) that the greatest professional knowledge and skill may coexist with an entire ignorance of the proper methods of employing this knowledge to aid the administration of justice.

Some Chemical experts have shown so little sense of their true position in Court, that at important trials they have not only altered the facts given in evidence to suit the views of the accused for whom they appeared, but they have described their own analyses as those only on which reliance should be placed. They have claimed almost exclusive experience in the scientific matter at issue, and have denounced as incorrect, before a tribunal utterly incapable of forming a judgment on such subjects, the chemical processes of experts of equal standing on the other side! A chemist who was giving evidence as an expert in a patent case, at a trial before the late Baron Alderson, was asked by his counsel whether he had had much experience on the subject then under inquiry. He replied by saying that he had had very considerable experience, more than most chemists, and was apparently about to announce himself before the Court as the sole standard of what was correct in that department of science; when the learned judge interrupted him with the remark,—'Do not praise yourself or your proceedings, sir; the jury will estimate the value of your evidence when they come to consider the whole of the case.'

Men who thus act damage not only the cause on which they are summoned, but they bring scandal on the evidence of experts in general.

The subject of experts, and the mode in which their evidence should be received, has been ably handled, in a legal point of view, by Mr. Stephen ('Criminal Law,' p. 209). He objects to the proposition of referring scientific questions to them, even when nominated by the Court, and he considers a common jury better qualified than experts to deal with and decide on all points of scientific evidence. One of the reasons which he assigns for his objection will probably surprise the medical reader: it is, that experts so nominated and employed, i.e. as assessors to the judge and in the absence of a jury, would *only direct their minds to the truth.* 'A juror,' he observes, 'is not a scientific inquirer, but a judge bound by oath to say whether or not certain evidence satisfies his mind; a scientific inquirer is not bound by anything of the kind.' He considers the suggestion to be based on a misapprehension of the result to be reached, and the mode of reaching it: 'It assumes that the object of the inquiry is the attainment of truth simply, and that scientific men are more likely to attain it than others. To this it may be replied, that the result to be reached is not truth simply, but such an approach to truth as the average run of men are capable of making, and that the result is more likely to be found in the opinions of common than scientific jurors.'

(*Loc. cit.*) On this it may be observed, that while experts have the same power of dealing with common things as common jurors, they have an additional special power of making that approach to truth on scientific subjects, which common jurors certainly do not possess. It would also appear from this reasoning, that in a judicial inquiry affecting a person charged with murder, something less than truth is more satisfactory for the purposes of justice than truth itself!

But the question regarding this employment of experts as assessors, and the avoidance of the imputation of their appearing as hired retainers in a case, is practically answered in the Admiralty Courts. Four Masters of the Trinity House, experienced in all the rules of navigation, give their opinions on questions submitted to them, as experts, by the Court; and without creating any charge of injustice in the decisions of the Court, they constantly guide these decisions by answering certain difficult nautical questions. In a case in which two ships come into collision, both parties contend they are right, or the case would not be litigated. The question turns upon the respective positions of the ships, the setting of certain sails, the direction of winds, tide and currents, and whether the helm should have been ported or starboarded before the collision. These nautical experts, as their opinions are now received, acquit themselves with satisfaction; but if such a trial took place before a jury, and each captain were allowed to select his own experts as witnesses, there would be the same dissatisfaction as that which now exists in reference to trials involving other branches of scientific evidence.

There can be no doubt that the present system discourages some eminent and upright men, who could by their special knowledge solve many important questions, from appearing as witnesses. I am and have been acquainted with several who have uniformly refused on this ground to attend as experts in a Court of Law. A distinguished chemist, a gentleman of strict honour and integrity, was once asked by counsel,—in the first question put to him in cross-examination, 'When and by whom were *you* first *retained* in this case?' Without directly imputing bribery and perjury to the witness, the innuendo to the Court and jury was to the effect that this gentleman had, like a lawyer, received his fee to maintain a client's cause, wholly irrespective of the oath which he had taken. As counsel on both sides look on the experts opposed to them in the light of hired advocates, it is obvious that so long as this system lasts, it must have a deterring effect on the higher and better class of witnesses, who, whenever they have the option, will avoid placing themselves in such a position as to have imputations of venality and untruthfulness thrown out against them in a public Court. In a correspondence with the late Dr. Andrew Combe of Edinburgh, many years since, he informed me that he had been consulted in a case in which a gentleman was considered to be incompetent to manage his affairs. He says in his letter: 'I was required to go and examine him on twenty-four hours' notice, but I insisted first on receiving some account of him, and being allowed to form an unbiassed opinion of the results of the examination. With some difficulty I obtained his history, and on perusing it saw a strong probability that my opinion would be adverse to those who consulted me. They of course professed pure impartiality, but it was manifest that my opinion was expected to confirm theirs. Had I been called by the Sheriff, for example, I might have given impartial evidence.' The late Dr. Baly, Dr. Munro, Dr. Wood, and myself were required to give our opinions in a similar case. We insisted upon being allowed to make a full examination of the alleged lunatic, and the result was that our opinions were completely adverse to those who consulted us, much to their disappointment (see p. 1129). We declined to give evidence in the case. It is a fact worthy of note, that even in criminal trials, where life is concerned, no provision is made by the English law for the calling by a judge of independent medical witnesses or experts, interested only in the manifestation of the truth. (Stephen.)

Medical Counsel.—Some barristers, who feel themselves unable to discuss the medical bearings of a question, are in the habit of employing medical men to instruct them on the best mode of endeavouring to baffle medical witnesses, so as if possible to place the case in an equivocal light before a jury. In short, there are some in the profession always ready to act as medical counsel, and to be 'retained' for the prosecution or defence, as the case may be. It is obvious that even if interference were prudent, under the present system of summoning medical witnesses, the law could not interfere to check a practice which is certainly liable to lead to evil results: for the parties who give the suggestions which may suit the purpose of an advocate do not always act as witnesses, and therefore cannot have their own means of knowledge or sources of experience fairly tested, while the *selected* medical facts or opinions which they may communicate to the advocate may have the intended effect of confusing the minds of the jury. Under these circumstances, the result must depend on the acumen and medical knowledge possessed by the judge who tries the case.

The question has been frequently asked, May not a medical witness honestly take up the defence of a prisoner? Is it always certain that the case for the prosecution is indisputably correct? The latter question admits of a simple answer, which will show the course that may be fairly pursued. The evidence for a prosecution may involve a serious medical error, as well as the evidence for a defence. Assuming, from his knowledge of the ascertained facts of the case, a witness believes *bonâ fide* that the medical opinions for the prosecution are incorrect or contrary to his own experience, he has a right to interfere and point out what he considers to be an error of fact or opinion. What he has to state, however, in this behalf should be publicly stated on oath, so that his experience, motives, and honesty of purpose may be fairly and openly tested by a cross-examination. He should remember that his interposition is only justifiable in the interests of justice as well as of the *public*, and not in the personal interest of the accused. If he is retained and paid by the prisoner's legal advisers to defend the prisoner's interest, wholly irrespective of the public interests, he is simply a medical counsel or advocate, and any professional opinions which he gives in the witness-box should be rejected on the principle that no advocate should be a witness and no witness an advocate. Under these circumstances his evidence is given for a special purpose and paid for accordingly, and it would be contrary to human nature to suppose that a witness so situated could give those free and unbiassed opinions which are requisite for the guidance of a jury. It is this kind of interference, on the part of some medical and scientific witnesses, which has laid the whole profession under a general censure. When, as in certain criminal trials, men thus hire themselves solely for the purposes of a defence, i.e. to rescue an accused person from the penalty due to a crime which there may be strong reason to believe he has committed, they may justly be called, in the language of a great lawyer, traffickers in evidence. It is not surprising to find that evidence should be manufactured on such occasions to meet the requirements of the defence. In one important case (*Reg.* v. *Tawell*, Aylesbury Assizes, 1845), a woman died from the effects of prussic acid, and a fatal quantity of that poison, amounting to one grain, was clearly discovered in the stomach of deceased by an experienced chemist. As, from the moral and circumstantial evidence, the guilt of the man could scarcely be disputed, an attempt was made to destroy the effect of the chemical evidence, and to impose on the common sense of the jury, by the statement that the deceased had eaten some apples, that the pips of apples contained the principles for producing prussic acid in the human stomach, and that the poison found in this case had resulted wholly or in part from the apple-pips! This monstrous chemical proposition met with no acceptance from the jury; they preferred the doctrines of common sense to this pseudo-scientific theory. The interference in this case for the defence could not have been based on any *bonâ-fide* belief that the chemical evidence for the prosecution, on which the conviction of the prisoner chiefly turned, was untrustworthy. The inventors of this hypothesis had not the excuse that public justice, or the life of an innocent man, was in danger from any medical or chemical error; and the only other object which can suggest itself is, that they worked to procure the acquittal of the prisoner by endeavouring to mystify the jury and mislead the Court on a simple scientific fact. A striking instance of an attempt to deceive a jury in a civil case, by manufactured chemical evidence, occurred a few years since under my observation. An action was brought against a Company for alleged damage to cattle by the smoke of a flue connected with some lead-works. It was said that plaintiff's cattle had been poisoned to a great extent by the deposit of lead on the herbage for a great distance around. The grass, shrubs, hedges, &c. on the plaintiff's ground underwent an inspection or a view before the trial by chemists on both sides, attended by some members of the special jury; but no deposit of lead could be seen anywhere, nor was any pointed out to those who attended on the part of the defendants. During the trial in Court, however, a cut branch of a tree was produced, and this was covered by a well-marked white deposit (white-lead), concerning which there could be no doubt whatever. The chemists on the part of the Company, however, made this observation—the under-surfaces of the leaves were as much covered with white-lead as the upper surfaces—a circumstance not consistent with the supposed deposit from a flue. But a still more surprising condition was noticed—the *cut surface* of the branch was as much covered with a white deposit as the bark and leaves. It was difficult to conceive that this could have arisen as a deposit from a flue, and the facts appeared to be only explicable on the theory that a branch of a tree had been secretly dipped into the defendant's lead-washings and dried,—the person who performed this experiment not having been sufficiently careful or thoughtful to keep out of the water the cut end of the branch! This would probably have gone to the jury as evidence of a deposit of lead from the flue; but, as the subject had attracted the special notice of defendants' witnesses, those who were interested in the plaintiff's case quietly withdrew the branch and thrust it under the table of the Court. Such practices are not calculated to give a high value to chemical evidence; but I believe conduct of this kind to be quite exceptional.

In civil cases it is not always easy to say, until the evidence has been heard in Court, whether scientific opinions should be in favour of plaintiff or defendant; and herein lies the great advantage arising from the opinions of scientific experts employed as assessors. There may be on each side a portion of truth which will meet with its medical supporters, without any imputation upon their motives, any more than upon the motives of the members of a special jury, who, in spite of perfect absence of bias, cannot always agree. If, however, medical men, intending to act in the capacity of witnesses, lend themselves as advocates to the party consulting them, for the purpose of weakening or overthrowing the scientific evidence on the other side, in spite of its consistency with sound medical doctrines, then they lose sight of their true position, and justly expose themselves to severe censure. If, on hearing the evidence to facts on the side of the party consulting them, they find the complexion of the case altered, and that they cannot support it as they believed they were in a position to do, it is their duty to themselves and their profession as well as to the public interests—which are always superior to private interests—to withdraw from the case. No man should ever appear to support that which he does not believe to be true.

Actions for compensation in railway accidents have brought to light some practices among certain members of the profession which have repeatedly called for the censure of the Bench. These persons have allowed themselves to be retained by the Company as surgeons to attend on those who have suffered njury; they have then been employed to suggest terms for compensation, so s to avoid litigation, and if possible to keep the case out of Court. So far no public injury may possibly accrue, although the financial part of the transaction is in the province of an attorney, and not of a surgeon; but when he case comes to trial, the matter assumes an entirely different aspect. The medical attendant of the Company, who has seen the injured plaintiff, but in he interest of the Company, and can probably give the best evidence of the njuries which he has sustained, is so situated, that anything which he may ay will necessarily have the taint of bias and self-interest. Medical men ave thus been strongly condemned by judges for degrading their profession y lending themselves as money-agents for the defendants.

Other practices, too, of a more remarkable nature have come to light. In a reported trial of this kind, which took place during the Summer Assizes of 1865, there was a conflict of medical evidence respecting the condition of the plaintiff, the witnesses on one side taking the view that he had sustained serious injury, and those on the other that he was either shamming or greatly exaggerating his symptoms. One medical witness, who adopted the shamming theory, and who appeared on the part of the Company, had attended the plaintiff and prescribed for him, as an experiment, syrup and water, under which it was stated he improved! This satisfied him that the man was shamming. It appeared, however, in cross-examination, that although the witness was paid for his services by the Company, he knew that the plaintiff believed at this time that he was acting as his own medical attendant. This mode of getting up scientific evidence for the Company was justly and severely condemned by the learned judge who tried the case. A medical man's own judgment should suffice to prevent him from falling into errors like these; he thereby not only damages himself, but the profession of which he is a member. Men who adopt these practices should know that they are not in a position to give unbiassed evidence, and therefore should decline to appear as witnesses.

Medical counsel and medical witnesses are differently placed in relation to a case under investigation. While the medical counsel may have undue weight given to his suggestions, in their being put boldly forward by the barrister who retains him, in forcible and impressive language, as ascertained medical truths, he entirely escapes that searching examination into his competency which is infallibly the lot of a medical witness; and again, while the latter is bound by his oath, without reference to the prosecution or defence, to state the *whole* truth, the former is only obliged to give so much of the truth as may suit the case of the party for whom he appears. In short, like a barrister, he is not an advocate of any abstract principle of justice, but of the cause of his client. How far a medical man has a moral right to make use of his professional knowledge in order to embarrass the testimony of those of his professional brethren who are compelled by law to appear and give evidence to the best of their ability, is an ethical question which it is here unnecessary to consider; but there can be no doubt, that while in some few instances the practice may work well, by preventing convictions from taking place upon erroneous opinions, it is liable in most cases to be perverted to the worst purposes. An unscrupulous man, who chose to make himself thoroughly acquainted with scientific subjects, might in this way so pervert the medical facts of a case, and lead to the confusion of witnesses who are not able to cope with him, as to procure an acquittal in face of the most convincing proofs of guilt. The remedy for this evil is in some measure with the medical witness himself. By having his mind fully prepared on the subject before entering the witness-box, he will have no occasion to fear an encounter with members of his own profession, thus disguisedly working against him. A plain statement of the whole truth, with the fact that he shows by his evidence that he has no end to serve but the public good, will enable him to put down the sophistry, medical or legal, that may be thus arrayed against him.

It has been strongly stated that no man acting as medical counsel or adviser should on any occasion be allowed to act in the capacity of a witness. Undoubtedly a man who takes up a case with a view of dressing up the facts for one side only, and collecting evidence for defeating by mystification the case on the other side, is not in a position to act as a witness with any credit to himself, to his profession, or to those who summon him. His object is neither truth nor an approach to it, but rather the gaining of a victory *per fas aut nefas.* There is no law by which such persons can be prevented from acting as witnesses; but, as a rule, their evidence is either rejected or received with great distrust. Their conduct also, if carried on openly in court, might give rise to severe comments from the judge and opposing counsel. In some cases the cross-examination of such persons would be a benefit, since it might have the effect of showing that many of the questions which they had suggested in the case were based upon erroneous views or in ignorance of the real facts. A medical witness may, without any imputation upon his *bona fides*, explain medical points to counsel, and correct him on medical subjects when wrong in his views or statements; but he should avoid even the appearance of prompting counsel in the conduct of the case.

Conflicting Medical Testimony.—The conflict of opinion among medical witnesses and medical experts is a favourite theme of comment with a portion of the public. The reader will find some remarks on this subject at p. 1083, n reference to Commissions of Lunacy. I have little to add to them, for imilar remarks apply to all medico-legal cases which come before a Court f Law. That men should be found who can traffic in evidence is certainly a misfortune for the profession to which they belong, but differences of opinion n the same state of facts may fairly exist in the medical as well as in ny other profession. If such differences come more before the public on edical or scientific questions, it arises from the fact that the cases demanding such evidence are far more numerous than those which affect the wo other learned professions. In suits which involve the rights and duties f the clergy, there is seldom agreement among those who have to decide pon them as ecclesiastical authorities. So among members of the legal rofession, and in the administration of justice generally, while barristers otoriously differ and give conflicting written opinions upon the same state f facts, special jurors, consisting of highly-educated men, are unable to ree in opinion, and are often discharged without a verdict, to the great injury litigants. If in a great patent case, after a series of appeals, learned judges emselves differ *toto cœlo* in the construction of the law, and are obliged read conflicting written judgments *seriatim*, it may be surely permitted to entific men also to differ conscientiously from each other without any putation of interested motives. The fact that the venal evidence of 'hired' perts or witnesses occasionally finds its way into a case, does not justify sweeping denunciation of medical or scientific witnesses as a body. As . Stephen remarks of the Law, so it may be said of Medicine—no system of rules can fully embody that line of conduct by the observance of which those who exercise a noble profession with honour and credit are distinguished from those who disgrace it. It is purely a matter of sentiment and good feeling.

It is truly a sad day for science, as one learned judge remarked, when the conflict of opinion may be traced to the ignoble motives of a desire of gain or of notoriety, or of anything but a desire for truth. At the trial of *William Palmer* (May 1856) the conflict of medical testimony is considered to have reached its maximum degree. The only question at issue was—'Death from strychnia or disease?' If the former was true, the guilt of the prisoner could not for one moment be questioned, as it was in evidence that Palmer had given to the deceased the food and medicine which he took on the day of his death. The suggestion of suicide or accident could not be entertained. On the main fact, however, the conflict of testimony was only apparent, not real, since one of the principal scientific witnesses for the prisoner admitted, when cross-examined by the learned Attorney-General on the part of the Crown, that he had again and again asserted that this was a case of poisoning by strychnia, but that the scientific witnesses for the Crown had not known how to find the poison in the body of the deceased. If this was his honest conviction from the facts known to him, it is obvious that he was voluntarily placing himself in a false position in coming forward as a witness for the prisoner. In so appearing, however, and in taking an oath to state the *whole* truth, his evidence should have been to this effect: 'I am of opinion that the deceased died from strychnia;—no person can possibly die from strychnia without some portion of the poison necessarily remaining in the dead body. It was not found in this case, because the chemical witnesses for the Crown did not know how to find it. By my process I could have detected strychnia in this body.' Had this straightforward course been adopted, the Court and public would have seen at once that in the most material part of the case there was really no conflict of testimony. The jury, as this witness well knew, were not there to decide upon the relative ability of chemical experts, or on the best process of analysis for detecting strychnia, but simply whether the deceased did or did not die from this poison. The remarks of the learned Attorney-General upon the evidence of the witness who had thus compromised himself convey in a few words a fair warning to all medical counsel who are inclined to imitate such an example as this:—

'I have seen that gentleman not merely contenting himself with coming forward, when called upon for the purpose of justice, to state that which he knew as a matter of science or of experiment, but I have seen him mixing himself up as a thorough-going partisan in this case, advising my learned friend, suggesting question upon question, and that in behalf of a man whom he has again and again asserted *he believed to be a poisoner by strychnia*. I do not say that alters the fact; but I do say that it induces one to look at the credit of such witnesses with a very great amount of suspicion. I reverence a man who from a sense of justice and a love of truth—from those high considerations which form the noblest elements in the character of man—comes forward in favour of one against whom the world may run in a torrent of prejudice and aversion, and who stands and states what he believes to be the truth; but I abhor the traffic in testimony to which I regret to say men of science sometimes permit themselves to condescend.' (Report of Trial of W. Palmer, p. 287.)

From these remarks, a medical witness will learn not only what he ought to do, but what he ought not to do, in taking up the defence of a person who is charged with crime. The scandal attending such displays as these, whether considered in relation to science or jurisprudence, may, it appears to me, be removed either by the appointment of experts as assessors to the Court, or by giving a power to the judge to summon to his assistance independent scientific witnesses.

THE
PRINCIPLES AND PRACTICE
OF
MEDICAL JURISPRUDENCE.

CHAPTER 1.

UESTIONS CONNECTED WITH THE DEAD BODY—SIGNS OF DEATH—CESSATION OF RESPIRATION AND CIRCULATION—APPARENT DEATH—TRANCE—COLDNESS OF THE BODY—POST-MORTEM CALORICITY—RIGOR MORTIS—CADAVERIC RIGIDITY—CIRCUMSTANCES WHICH INFLUENCE ITS COMMENCEMENT AND DURATION—OTHER INDICATIONS OF DEATH.

AMONG the subjects which sometimes claim the attention of a medical jurist, n reference to the bodies of persons found dead, are the conditions known as eal and apparent death, the proofs of death, and the priority of death. A nowledge of the changes which take place in the dead body at a recent, as ell as a remote period, may be usefully applied to the determination either f the reality of death, a problem seldom involving difficulty, or of the period which death took place, a question of considerable importance, and upon hich the guilt or innocence of an accused person may frequently depend.

Medical jurists have enumerated certain signs or indications of death. It ill be necessary to consider these in the order in which they commonly present themselves to the observer.

1. Cessation of Circulation and Respiration.—The cessation of these o important functions is regarded as, in itself, sufficient to determine the ality of death. But persons have been resuscitated from a state of asphyxia; d others again have recovered from a state of lethargy or catalepsy, when all appearance, the respiratory and circulating processes had been comtely arrested. Life is certainly not incompatible with a temporary suspenn of these two important functions; but, in making this admission, it is deniable, that the processes must be speedily re-established, or death will uredly follow. One remarkable case illustrative of the maintenance of life der a partial suspension of the action of the heart and lungs, is recorded Dr. Cheyne. It is that of Colonel Townshend, who appears to have posed the power of voluntarily dying:—*i.e.* of so suspending the heart's ion, that no pulsation could be felt. After lying in this state of lifelessness a short period, active life became slowly re-established; but without any

volition or consciousness on his part. The longest period during which he remained in this inanimate state, was about *half an hour.* It is probable, however, that the heart's action was not entirely suspended during the whole of this time, but that respiration and circulation were feebly continued at intervals; so slightly as to be imperceptible to the examiners, or to be indicated by a pulsation of the radial artery. The stethoscope had not been then invented, and the method of detecting the sounds of the heart by auscultation was wholly unknown. A hybernating animal would appear to be dead under similar circumstances, but it is known that circulation and respiration still continue in a sufficient degree to maintain life. M. Bouchut has proved that during hybernation, an animal is simply in a state of apparent death. The vital functions are not arrested, but are reduced to their lowest ebb. Thus he found, in his experiments on the marmot, or mountain rat, that when the animal was in an active state, the pulsations of the heart were 90; while in the torpid state they were reduced to 8 or 10 in a minute. ('Ann. d'Hygiéne,' 1848, 2, 96.) In the case of Colonel Townshend, it is obvious that the action of the heart may have continued, although the pulse at the wrist and other parts of the body failed to indicate this. It appears that the Colonel really died nine hours after the performance of the experiment above mentioned. His body was carefully examined, but nothing could be detected to account for the extraordinary power which he possessed over the action of the heart. This case, which rests upon good authority, must be regarded as altogether exceptional. It may, however, serve to throw some light upon the possible survivorship of persons, who have been exposed to death by drowning, and whose bodies may have been immersed in water for an unusual period of time.

In some works on the subjects of apparent death and asphyxia, cases are recorded which are intended to show that respiration and circulation may be suspended for many hours, and yet the person be living. It is impossible to place any credit on narratives of this description, which generally rest upon hearsay or conjectural evidence. To suppose that the two important functions of respiration and circulation can be wholly suspended for even an hour, in a human being, without destroying life, is to set at defiance all physiological experience. Admitting the possibility of such a case occurring, it would require the best and most unequivocal evidence to support it. The phenomena of hybernation in many animals can have no reference to this condition: for in these, a final purpose is answered by the feeble state of existence into which they are thrown. While it is natural for such animals to remain torpid during the winter season, or to exist under a feeble exercise of their functions of respiration and circulation, it would be an unnatural condition for a human being, and inconsistent with the maintenance of life.

There are some forms of disease affecting the nervous system, as, for example, hysteria accompanied by tetanus, or coma,—and catalepsy, the symptoms of which are occasionally such, as closely to simulate death. Respiration and circulation appear either to cease entirely, or to be carried on so feebly, that, to uninformed observers, the persons affected, may seem to be really dead. Catalepsy, or, as it is vulgarly called, *trance*, in which the person lies in an unconscious state, may thus assume the appearance of death; but the warmth of the body is retained, the limbs are flexible, and the heart and lungs continue to act, although less vigorously than natural. Cases of prolonged and profound sleep of a natural kind, which have also been described as cases of trance, cannot be mistaken for death. Dr. Cousins met with a remarkable instance which may be taken as the type of others. A man of healthy habits, forty-three years of age, was at intervals subject to attacks of long and persistent sleep. He would retire to bed at his usual hour, and, without any warning symptoms, suddenly and almost immediately fall into a profound sleep, from which all the usual means would fail to arouse him. In this state, his face and ears were pale; the skin was pale and generally warm, but his feet were cold and livid, and the limbs quite relaxed. His pulse was soft, slow, and feeble; his respirations almost imperceptible, amounting to about eight or nine in a minute. He appeared like a person in a refreshing, tranquil slumber. There was no stertor or snoring. The longest period he ever passed in profound sleep, was five days and five nights. He frequently slept three days and occasionally four days without waking, but his average period was two days. His secretions were suppressed, and no food was required. He commonly awoke suddenly, had no consciousness of the lapse of time, and retained a good remembrance of the last occurrences before he fell into this state. He had no dreams. ('Medical Times and Gazette,' April 18, 1863, p. 396.)

A similar case, from the 'Gazette Médicale,' is reported in the 'Edinburgh Monthly Journal' for April 1845. A married woman, thirty-six years of age, became subject to attacks of prolonged sleep or trances, lasting from two to seven days, but usually about five days. They occurred suddenly without warning, sometimes during the night, and sometimes during the day. After twenty-four hours she was half roused, and her lips moistened with liquids which she swallowed insensibly, again falling asleep immediately afterwards. These trances generally occurred at intervals of from two to twenty days, during which she had no regular sleep, or, if any, it was short and disturbed. The evacuations were suspended during this state. It was found impossible to rouse her; but she awoke spontaneously, feeling much fatigued and not refreshed by this unnatural sleep. When an eyelid was lifted, the eye was found to be fixed upwards; light did not cause her pupils to contract. The respiration, circulation, and temperature of the body were in their original state, during and after these trances. ('Gazette Médicale,' January 1845; and 'Edinburgh Monthly Journal,' April 1845, p. 307.)

It has been demonstrated by Mr. Durham, that in ordinary sleep, there is a withdrawal of a due supply of blood from the capillary vessels of the brain. The remarkable fact is, that the proper supply of this fluid to the brain, should be so long withdrawn or suspended, without producing serious injury to the nervous system. This condition appears to be a kind of human hybernation. It could not be mistaken for death, even by the most ignorant observer, considering that respiration and circulation are still carried on, and the warmth of the body is retained.

Certain tests have been proposed for the purpose of ascertaining whether these processes have ceased or not. It is unnecessary to allude to them, because they appear to be wholly inadequate to the purpose intended; but in the absence of all appearance of movement in the chest and abdomen, a medical man may readily satisfy himself of the fact of respiration and circulation continuing or not, by the occasional application of a stethoscope, or of the ear itself, to different parts of the chest,—especially to the region of the heart. The auscultatory test, applied at intervals during half an hour, cannot fail to lead to a satisfactory conclusion. This test, first proposed by M. Bouchut, and rewarded by the French Academy with a prize, as being the most certain method of proving death before putrefaction, has been objected to by Dr. Dowler, 1, because the heart itself may, like other muscles, be in a state of apparent, and not real death; and 2, because the pulsations and sounds of this organ may not always be appreciable to the ear, even when aided by the stethoscope. In support of these objections, it is stated that M. Brachet has repeatedly restored the vitality of new-born children, in whom no pulsation whatever could be discovered for a period of fifteen to thirty minutes after birth. In one instance a child was revived after *twenty minutes* of apparent death, by insufflation of the lungs, although during that time no pulsation could be heard or felt. Another case was that of a man, æt. thirty-three, whose heart presented no contraction that could be detected during at least eight minutes, although the ear was applied again and again. *Twenty minutes* after the suspension of its action, a slight contraction was perceived in the heart, its pulsations then became regular, and the patient opened his eyes. ('Philadelphia Medical Examiner,' Oct. 1850, p. 599.) To these may be added the case of Colonel Townshend, which carries the supposed period of the entire suspension of the heart's action to half an hour. Such cases however do not show that a person can live while the heart's action is thus continuously suspended, but that the means employed for testing the state of this organ have been imperfectly or carelessly applied.

In awarding the Manni prize, founded for the discovery of a certain sign of death, the French Commissioners, Dunéril, Andral, Magendie, Serres, and Rayer, very properly dwelt upon the state of the heart as furnishing the most unequivocal proof of death before the occurrence of cadaveric rigidity and putrefaction. M. Bouchut, to whom the prize was awarded in 1846, found, in an extensive series of researches, experimentally confirmed by the Commissioners themselves, that in all cases of apparent death, whether arising from asphyxia or syncope, there is one common character by which they may be distinguished from real death, and that is, a continuance of the pulsations of the heart. He established the fact, that in the most perfect state of syncope, attended with entire loss of motion and sensation, as well as cooling of the body, the contractions of the heart were not really at any time suspended, but simply reduced in force and frequency. In syncope from hæmorrhage, carried to the fullest extent, and in cases in which respiration was either imperceptible, or carried on at long intervals, the body at the same time having the aspect of a corpse, he was enabled by auscultation, to detect the pulsations of the heart, and thus to distinguish apparent from real death. In children born in a state of apparent death, and in cases of asphyxia from any cause, in narcotic poisoning, hysterical and epileptic coma, and in all diseases which have been stated to resemble apparent death, the living has been easily distinguished from the dead body by the continuance of the heart's action—this was feeble and took place at intervals, but it was always sufficiently marked to enable a professional man to distinguish a living from a dead body.

It was considered important, if possible, to define the periods at which, after the entire cessation of the heart's action, a person might be pronounced dead. Assuming that the last audible expiration has been made, that the motions of the chest have apparently ceased, and that no pulsation can be felt in any of the arteries of the neck or limbs, the longest interval that elapsed between the pulsations of the heart was about six seconds. M. Rayer, one of the Commissioners, from his own observations on the dying, assigned as a maximum, an interval of seven seconds between the last pulsations of this organ. If, therefore, no motion of the heart is perceived during an interval of *five minutes*, a period which is fifty times as great as that which observation warrants, death may be regarded as certain. With the cessation of the pulsations of the heart, the usual cardiac sounds also cease. At the same time, their cessation furnishes a proof that respiration has ceased, and that the functions of the nervous system are not merely suspended, but destroyed. ('Annales d'Hygiène,' 1848, 2, 78.)

In reference to *Respiration*, the alternate motions of the chest and abdomen serve better as a means of diagnosis, and are more readily observed, than the motions of the chest alone. In the absence of a stethoscope, an opinion may be formed from an external view of the body by the following arrangement. An even piece of looking-glass, plate glass, or a basin of water or of mercury, may be placed upon the front of the chest, and the image of some object allowed to be reflected from a window, or other strong source of light. The slightest motion in the reflecting surface will be indicated by an alteration in the image of the object reflected. A well-informed practitioner can, however, generally determine the question without resorting to experiments of this description.

The entire cessation of breathing, in the opinion of the late Sir B. Brodie, should be regarded alone, as a decisive test of the extinction of life. The movements of respiration cannot be overlooked by any one who does not choose to overlook them, and the heart never continues to act for more than four or five minutes after respiration has ceased. This organ has been properly described to be the *primum vivens*, and the *ultimum moriens*, the first to live and the last to die. The proofs of its continued action, however, are less obvious to the unskilled observer, than the movements of the chest; hence the visible cessation of these movements for a period of five minutes, furnishes a certain proof that the person is really dead. But the skilled observer would apply the test of auscultation, and before giving an opinion would satisfy himself of the permanent cessation of the heart's action. It is impossible to admit that the heart can remain for even half an hour in a state of inaction in a human being, and then spontaneously recover its activity.

2. Coldness of the Body.—One of the most striking characteristics of life is the power which the body has, of retaining a temperature far above that of the medium in which it is ordinarily placed. Notwithstanding that the body is constantly subjected to the same laws of cooling as all other heated solids, i.e. by radiation, conduction, and convection, the supply of heat internally, is so constant and uniform, as to counterbalance exactly the loss which is experienced. Some physiologists consider that animal heat depends entirely on the chemical changes produced by respiration; but it is probable that the nervous system plays an important part in its production. ('Edinburgh Medical Journal,' vol. 58, p. 249.) When, therefore, life is extinguished, the body will gradually lose the heat which it possessed at the moment of death, just like so much inert organic matter artificially raised to the same temperature.

There is considerable discrepancy among physiologists, concerning the natural temperature of the *living* body. The average temperature of the interior of the body in health, varies from 98° to 100°. It is liable to be increased in some diseases, and to be diminished in others. In one case of typhoid fever, M. Piorry states that he found the blood to have a temperature of 113°; and the temperature of the uterus during parturition, is said to have been found still higher.

The time usually assigned for the cooling of the dead human body to the temperature of the air, is from fifteen to twenty hours, but it varies according to the condition of the body at the time of death, the mode of death, and the circumstances under which it has been placed. From January to June 1863, Dr. Wilks and I collected observations on the cooling of the dead body in one hundred cases, at Guy's Hospital. The age, the cause of death, and the circumstances under which the bodies were exposed, were at the same time noted. The reader will find the details of these cases in a table published in the 'Guy's Hospital Reports' for October 1863, p. 184. A summary of the observations of temperature recorded in this table, leads to the following conclusions. If the periods of time be divided, first, into those which are included between two and three hours; secondly, between four and five hours; thirdly, between six and eight hours; and fourthly, twelve hours, including one or two cases extending to fourteen hours, the results were as follows:

	First period, 2 to 3 hours	Second period, 4 to 6 hours	Third period, 6 to 8 hours	Fourth period, 12 hours
Number of observations .	76	49	29	35
Maximum temperature of the body . . .	94°	86°	80°	79°
Minimum temperature of the body . . .	60°	62°	60°	56°
Average temperature .	77°	74°	70°	69°

The temperature was tested by simply placing the exposed bulb of a thermometer on the skin of the abdomen. It should be remarked, however, that as the observations could not be commenced until the bodies were brought to the dead-house, and a variable interval elapsed, during which they remained in the ward, these temperatures are lower than they would be at the respective periods, after death; as the body would necessarily cool to some extent before the first observation could be made. They, nevertheless, show that a dead body cools slowly and progressively, and that the trunk generally retains a well-marked warmth for ten or twelve hours after death.

If the circumstances under which a body is exposed are favourable to the loss of heat, it may be found cold in eight or nine hours after death. In the case of *Millie*, for the manslaughter of whom a man named *Bolam* was tried and convicted some years since, the body, although clothed, is reported to have been found cold about nine hours after death.

It is customary to judge of the degree of coldness by the sense of touch; but the dead human skin is a good conductor of heat, and thus the surface may appear cold to a moderately warm hand. The condition of the hand itself may lead to an erroneous impression. If the two hands are of different temperatures, a recently dead body may appear cold to one and warm to the other. Another fact should also be borne in mind, that in the chest and abdomen, the viscera may retain a well-marked warmth when the surface of the skin is actually cool or cold. Among the cases observed by Dr. Wilks and myself at Guy's Hospital in 1863, it was remarked that in several a high temperature was retained by the viscera for a long period after death. In two instances a thermometer indicated in the viscera a temperature of 76° in one instance seventeen, and in the other eighteen, hours after death,—the temperature of the air being comparatively low (49°), and the surface of the body cool. In a third instance, ten hours after death, while the surface of the abdomen had a temperature of 65°, the interior was 85° ('Guy's Hospital Reports,' October 1863, p. 193). In all observations on the temperature of the dead body, a thermometer should, if possible, be employed. This may be applied for the exterior, either to the skin of the abdomen or to the armpits, and for determining the temperature of the interior, the bulb may be introduced into the mouth, throat, or rectum.

When death has taken place suddenly, from accident, apoplexy, or acute disease, a body has been observed to retain its heat for a long period. It is stated, by Nysten, that the bodies of persons who have died from asphyxia by hanging, or suffocation, or from the inhalation of carbonic acid gas, do not cool, *cæteris paribus*, until from twenty-four to forty-eight hours after death; and that sometimes even *three days* have elapsed before the body has become completely cold. Too much importance must not be attached to this statement, since in some cases of fatal asphyxia, the body has been observed to cool just as rapidly as in death from other causes.

According to Dr. B. W. Richardson, a loss of blood, as in cases of death from hæmorrhage, whether the blood is effused externally or internally, or even temporarily withdrawn from the heart, as in syncope, is a cause of the rapid cooling of the body. He states that 'the decline of the temperature in these cases is so great, that the external surface of the body may actually run down to that of the air without death.' ('Medical Critic,' January 1863, p. 31.) The sudden cold of collapse observed on the surface of a living body, is here confounded with the slow and progressive cooling of a dead body. The cases which have been adduced in support of this view are exceptional instances of disease, and have no practical bearing on the question at issue—namely, the cooling of the body after the sudden death of healthy persons from wounds. Hence the conclusion drawn from them, 'if the body is left dead from direct and absolute loss of blood, cooling to the temperature of the surrounding medium is completed, in regard to the external surface, in two hours,' may lead to a serious error, and implicate an innocent person in a charge of murder.

An opportunity of testing the accuracy of this statement presented itself at Guy's Hospital in February 1863. A healthy man, æt. forty-seven, died suddenly from hæmorrhage. A ligature had been placed on the axillary artery in consequence of an accident: this gave way, and about four pounds of blood were lost. Four hours after death I saw the body of the deceased, and found the shoulders, chest, and abdomen quite warm. The skin of the abdomen had a temperature of 84°; eight hours after death the temperature was 80°, and the arms and legs were not rigid. The conditions under which this body was exposed, were favourable to rapid cooling: it was placed in a shell with a shirt loosely over it, and the temperature of the dead-house was 38°. The alleged effect of loss of blood in accelerating the cooling of the human body when death has occurred suddenly from hæmorrhage, has therefore no foundation in fact. The only physical difference which it would be likely to create, would be by simply reducing the amount of fluids in the body to undergo the cooling process. In the above well-marked case, the loss of four pounds made no appreciable difference in the rate of cooling.

It has been suggested that coldness of the body as a result of disease, whether arising from malignant cholera, phthisis, or other chronic disease, or from death during the stage of collapse in poisoning, might create difficulty in reference to an opinion respecting the date of death. It is stated that the bodies of persons who have died of these diseases, have been found quite cold on the surface within *four* or *five* hours; at least, as cold as the bodies of healthy persons after the lapse of fifteen or twenty hours. In such cases, coldness of the body is commonly manifested before dissolution, in those parts which are the most exposed, as in the extremities of the hands and feet, the nose and ears. Like all other diagnostic signs, when taken alone, coldness of the surface is open to this objection; but the obvious cause of death, and the emaciated state of the body, as well as the facts connected with the occurrence and disappearance of rigidity, even supposing that no history of the case could be obtained, would be sufficient to remove any doubt. The objection is of a speculative kind, and no instance has been adduced in which these morbid states have led to an erroneous medical opinion.

The physical circumstances which influence the cooling of a dead body are precisely those which influence the cooling of all heated inert substances. 1. The medium in which it is immersed. A body will cool more rapidly in water than in air—a fact which may be important in a question of survivorship in drowning; and it will cool more rapidly in the open air than in a dwelling,—on the floor than in bed, or under exposure to a current of air than in a warm, tranquil atmosphere. It will cool more rapidly in a large apartment than in one which is small. The dead human body cools, first, by radiation; secondly, by conduction; thirdly, if naked and exposed, by convection: consequently, its own mass, as well as the nature of the materials with which it is in contact, must modify the results. The body of an adult, *cæteris paribus*, cools more slowly than that of a child, or of an old person; and that of a fat or corpulent person cools with less rapidity than one which is lean and emaciated. Again, when the dead human body is placed on good conducting substances, or is exposed to the open air in a naked state, the cooling process will be hastened. If, on the contrary, it is much covered with badly conducting materials, as cloth, flannel, or cotton, and is allowed to remain on a bed, it will require more than the usual period of time to become cold.

The dead body, like so much inert matter, continues to cool until it reaches the temperature of the medium (air or water) to which it is exposed. As the soft solids are not good conductors of heat, the inner parts of the body are much longer than the surface in acquiring the temperature of the surrounding air; and, for the same reason, when once cooled, it is long before they reach the temperature of the air, supposing this to have risen. Thus, if a dead body is cooled to 60°, and the air in the room suddenly increases in temperature to 80°, the viscera may be found to remain for some time at 60°. The dead body is not, therefore, like a minimum thermometer in marking a low temperature, but, like all dead flesh, its temperature rises and falls with the thermometer, although more slowly than other solids possessing better conducting powers.

Mere coldness of the body is not incompatible with a continuance of life; for many morbid causes may modify, or even altogether suspend the production of heat in the living subject. Thus, in syncope or hysteria, it is not unusual to meet with extreme coldness of the skin; but this differs from the coldness of death, in taking place over the whole body *suddenly*, and in even preceding the state of apparent lifelessness. It does not depend merely, as in death, on the slow and gradual loss of heat, because it is perceptible even when the body is placed in conditions under which a heated substance would not become cold. Besides, the interior of the body at the rectum or throat will be found to have a higher temperature than the skin of the chest or abdomen. Let us take the opposite condition—Can the warmth of the human body be retained in its normal state for any length of time after death? We might suppose, *à priori*, that this question should be at once answered in the negative; but there are numerous authentic observations which show that heat may be sometimes long retained by the dead body, both on the surface as well as in the cavities; and it has been noticed, in certain fatal diseases, that the temperature has actually risen in the body after death. This exceptional retention of heat has given rise to the erroneous suspicion that the person was still living, as in the following case, a report of which appeared in the 'Lancet' some years since:—

A servant girl, who had retired to bed in apparently perfect health, was found on the following morning, as it was supposed, dead. A surgeon who was called in pronounced her to be certainly dead, and stated that she had probably been dead for some hours. A coroner's inquest was summoned for four o'clock of the same day, to inquire into the cause of death; and directions were given that a post-mortem inspection of the body should be made in the meantime. The reporter of the case was requested to give his assistance. Accompanied by the surgeon who had been consulted, he went to the house about two o'clock, for the purpose of making an inspection. The deceased was found lying on the bed, in an easy posture, on her left side, her body forming somewhat of a semicircle. The countenance was pallid, but so perfectly placid and composed, as to give to her the appearance of being in a deep sleep. The heat of the body, although she must have been dead eight or ten hours, was not in the least diminished. The room was carefully searched, but nothing in the shape of poison, nor any other means of self-destruction, could be discovered: every article of apparel lay around, as it might be supposed to have been left, by a person going to bed in perfect health as usual. The heat of the body not diminishing, a vein was opened, and various stimuli applied, but without producing any sign of resuscitation. Respiration and circulation had ceased; no artery could be felt pulsating in any part. Two hours had now elapsed since their arrival, and the parties still hesitated to perform the inspection, when a message was sent to them, stating that the jury were waiting for their evidence. The inspection was then commenced; but in moving the body for the purpose, the warmth and pliancy of the limbs were such as to suggest to the examiners that they were inspecting a living subject! The internal cavities were so warm that a copious steam issued from them when they were laid open. All the viscera were healthy, there were no signs of disease;—nothing appeared to account for death, and from what they saw, the inspectors regretted that they had not postponed the examination until the signs of death had been more completely manifested! For obvious reasons, the name of the place where this extraordinary case occurred, and the name of the reporter, were suppressed. It is probable that a high temperature was retained by this body for a much longer period than usual after death. There were, however, two physical causes in operation, the influence of which does not seem to have been sufficiently appreciated. The girl died suddenly while in a state of perfect health and vigour; and until the time of inspection, the body appears to have remained in bed closely covered by badly-conducting materials; *i. e.* the bed-clothes. The temperature of the room in which the body was found, is not stated; but as the month was October, it was probably not low. The temperature of the surface or of the internal organs, was not measured by a thermometer. Although there can be no doubt that this girl was really dead, yet, as a rule, no medical man is justified in making an inspection of a body until after the signs of death (coldness and rigidity) have been clearly manifested. Respiration and circulation had ceased, and no pulsation could be felt in the heart or arteries; the body had been in this state for at least eight hours; hence it is evident that this was not a case of apparent death. The examiners were simply deceived by an unusual retention of heat in the viscera (see *ante*, page 6). Doubts were entertained for several days respecting he death of the well-known Professor Dieffenbach, of Berlin. The unusual retention of heat, and the delay of the putrefactive process, led to the supposition that he was only in a state of apparent death.

It can scarcely be imagined that the production of heat should continue in really dead body; and yet certain facts connected with the malignant holera, yellow fever, and other diseases, appear to establish the possibility f this. In some cases of death from malignant cholera, when epidemic n this country, in 1832-3, the body, which had become moderately cold, as observed suddenly to resume its warmth, so that the temperature is stated o have risen some time after death as high as 87°, although circulation and espiration had entirely ceased. This singular phenomenon, like numerous thers connected with that disease, has received no adequate explanation. he death of the persons may have been only apparent and not real; and ossibly, a sudden reaction and distribution of blood through the capillary ystem, may have given rise to the effect observed. The fact of its occurrence must be taken as positive evidence of some latent vital power or chemical force still lingering about the circulating system; for in real death, the animal body, when it has once become cold, is no more capable of spontaneously generating heat within itself, than any of the inert and lifeless solids by which it is surrounded.

In a case of death from Asiatic cholera, Mr. Rumsey observed that half an hour after the complete cessation of respiration and circulation, the muscles of the arms underwent spontaneously various motions of contraction and relaxation, continuing for upwards of an hour, and that although previously cold, they then became evidently warmer. The restoration of warmth after the body has become cold in such cases, can only be explained by supposing that there still remains about it some lingering trace of vital action; although this may not be indicated by the presence of the ordinary signs of active life. The facts connected with the production of heat in the dead body, have not received much attention from physiologists.

Dr. John Davy met with some extraordinary high temperatures in the *dead* body. In a case of rheumatism, after the viscera had been exposed for nearly ten minutes, the mercury of a thermometer, placed under the left ventricle, rose to 113°, and when in contact with the lobulus Spigelii of the liver to 112°. In a second subject, examined *six hours* after death, the thermometer under the left ventricle indicated a temperature of 108°, and when in contact with the lobulus Spigelii 107°. In these cases, the patients were ill but a short time, and died suddenly; and the temperature of the apartment in which the observations were made, was 86°. This increase of temperature after death has been referred to putrefaction; but Dr. Dowler has shown that it takes place soon after death, and before rigidity sets in. Some of the cases reported by Dr. Wilks and myself also show that it may take place independently of putrefaction. (‘Guy's Hosp. Rep.’ Oct. 1863, cases 4, 26, 30, p. 184.) Dr. Dowler has called this condition post-mortem caloricity; he has noticed it as a common occurrence, in a warm climate, in the bodies of persons who have died from yellow fever. The heat of the body, according to him, continues to increase for several hours after death; and in one case, after six hours, he found the arm-pit to have a temperature of 100°, and the abdomen, of 103°. In another, the temperature of the arm-pit during life being 100°, it was found that in three hours after death, the temperature of this part had risen to 104°; in a third case, a similar increase was observed in thirty minutes. The highest post-mortem temperatures were observed in the thighs. Thus in a case in which the arm-pit had, during life, a temperature of 104°; in ten minutes after death it indicated a temperature of 109°, and in fifteen minutes after death, the thigh gave a temperature of 113°. When the maximum, which is variable in different bodies, has been attained, the body gradually undergoes the cooling process observed after death, and according to Dr. Dowler, this generally commences with the head. (‘Phil. Med. Examiner,’ Oct. and Nov. 1845, pp. 625 and 359.) In death from malignant cholera, he found that the dead body reached its maximum temperature of 109° in about an hour and a half. Dr. Hensley has published, in the same journal, a series of cases in old and young persons, who had died from different causes; these do not show a similar increase of heat, but they prove that after thirty hours, a dead body may retain a temperature two or three degrees above that of the room (March 1846, p. 151). These observations may serve to explain facts similar to those observed in the case of supposed premature inspection just now related, for they show that in some exceptional instances, a really dead body may retain for many hours a temperature as high, or higher, than that which is usually found in the living.

Dr. Dowler considers that the gradual loss of heat in the *interior* of the body, as determined by a thermometer, furnishes the best test to establish the reality of death. The living body maintains a uniform temperature, independently of that of the surrounding medium; but a dead body, like other inert matter, is governed in its temperature by purely physical conditions, 'heating and being heated, receiving and radiating caloric. This is not the result of speculation, but of prolonged and varied experimental research.' ('Phil. Med. Examiner,' Oct. 1850, p. 606.) It may be observed, however, that in temperate climates, the signs of death are sufficiently well marked by the progressive cooling and rigidity of the body, before the application of the thermometrical test to the interior could be made; hence, although it would furnish information that death had certainly taken place, a medical examiner could come to a safe conclusion without it. The occasional existence of post-mortem caloricity offers no objection to this conclusion, since cooling sooner or later follows this condition, as a result of ordinary physical causes. The coldness of the living body in cholera, congelation, hysteria, &c., is a physiological condition, and not the result of physical cooling. If death takes place, the coldness may continue, or the body may again become warm. In either case it passes ultimately, by physical cooling, to the temperature of the surrounding medium.

3. Cadaveric Rigidity. Rigor Mortis.—In from five to six hours after death and generally while the body is in the act of cooling, the muscles of the limbs are observed to become hard and contracted, the joints stiff, and the body firm and unyielding. This peculiar condition is known under the name of cadaveric rigidity. The first effect of death from any cause is in most cases a general relaxation of the whole of the muscular system. The lower jaw drops, the eyelids lose their tension, the limbs are soft and flabby, and the joints are quite flexible. The muscular tissue may be considered as passing through three stages in a dead body. 1. It is, as above mentioned, flaccid but contractile, although, as it will be seen hereafter, muscles contracted by living force in the act of dying, do not necessarily become relaxed in death; 2. It becomes rigid and incapable of contraction; and 3. It is once more relaxed, and does not regain its power of contractility. The body now passes into the incipient stage of putrefaction. The first stage defines the duration of muscular irritability; the second stage, that of cadaveric rigidity; and the third, that of the commencement of chemical change or putrefaction.

Its Seat.—Experiment shows that the seat of this phenomenon is in the muscular system, for the rigidity disappears immediately on the removal or division of the muscles. According to the experiments of Béclard and others, the rigid condition of the muscles is wholly independent of the integrity of the nervous system: for a division of the nerves leading to the particular muscles, or even the entire removal of the brain, has not been found to prevent it, or to retard its occurrence. It has also been observed, that when death has taken place from paralysis, hemiplegia, or apoplexy, the rigidity has been as strongly manifested by the muscles of the paralytic or hemiplegic, as by those on the healthy side, provided they are well nourished and retain some irritability. The muscles of shattered limbs in death from comminuted fractures, do not take on this condition. It is probable that the rigidity is due to a vital action in the muscular fibre; and possibly, as John Hunter imagined, it may be the last effect of the vital force on the muscular system. According to Küssmaul the living metamorphosis of the muscle has ceased; the muscle becoming rigid is a dying,—the perfectly rigid, is a dead muscle. Rigidity is in general observed to take place simultaneously with the coagulation of the blood throughout the body. Some have considered it to depend upon this: but not to mention that the alleged cause appears to be wholly inadequate to the effect produced, the rigidity sometimes occurs while the body is warm and the blood fluid, therefore this cannot be the true explanation: moreover it closely resembles the rigidity of syncope and asphyxia, which can have no reference to the coagulation of the blood.

M. Brown Séquard has found by experiments on rabbits that if a current of arterial blood is re-established through muscles in which cadaveric rigidity has already begun to show itself, they cease to be rigid, and recover their irritability. He even succeeded in removing the cadaveric rigidity from the muscles of the decapitated body of a criminal, thirteen hours after execution and two hours after the supervention of rigidity, by the injection of defibrinated human blood. The muscles lost their rigidity, and continued to contract on irritation for several hours. (‘Gaz. Méd. de Paris,’ Nos. 24 and 27; and ‘Amer. Journ. Med. Sci. Jan.’ 1852, p. 221.) These facts appear to show that the muscles on becoming rigid, still possess a vital power.

Rigidity is undoubtedly referable to the spontaneous contraction or rather stiffening of the muscles; until it appears, these organs are susceptible of galvanic and mechanical stimuli, but after it has ceased, this irritability of the muscular fibre is entirely lost. The power with which these organs contract in the rigid state, is far less than that observed, when they are subjected to the influence of volition in the living body. The contractile force is not so great as to induce any apparent alteration in the position of the parts to which the tendinous extremities of the muscles are attached;—so that there is no displacement, nor is any force of a counterbalancing nature, manifested between flexors and extensors. It is asserted that the flexor muscles are usually more contracted than the extensors, so that the limbs and trunk, as well as the fingers, if left undisturbed in the dead body, have a tendency to assume a state of flexion. As a general rule, however, the position in which the muscles may be, at the time of death, is that which they retain during the state of rigidity, whether the body be lying, sitting, or standing, and whether the limbs be in a state of flexion or extension. When the rigid state is strongly manifested, the muscles assume a prominence, as under violent contraction in the living body.

The *time* at which rigidity occurs after death, as well as its duration, is affected by various circumstances. It generally commences within *five* or *six* hours, and lasts from sixteen to twenty-four hours. Sommer assigns the time at which it occurs, after the cessation of respiration, as not later than seven hours. Nysten, who closely investigated this subject, considered that rigidity never made its appearance in the muscles, until the body had entirely lost its animal heat; but some of his own observations tend to show that this statement is not correct. Cases every now and then present themselves, in which after death, the limbs become rigid while they are yet warm; and it is the same with the trunk.

Ollivier observed, in cases of death from malignant cholera, that cadaveric rigidity occurred while the body was yet warm. He has also seen a rigid condition of the muscles in well-developed bodies, which were inspected in from six to eight hours after death. (‘Ann. d'Hyg.’ 1833, 1, 233.) M. Brown Séquard mentions the case of a man who died in one of the Parisian hospitals in 1849, in whose body cadaveric rigidity appeared three minutes after he had ceased to breathe, and while the heart was still beating twenty times in a minute, while the man was still alive, if life is considered to persist so long as the heart beats! These beatings ceased only three minutes and a half after cadaveric rigidity had shown itself everywhere. A quarter of an hour afterwards, there was no trace of cadaveric rigidity, and in less than an hour after death, signs of putrefaction had appeared in the limbs. This man died of exhaustion after prolonged typhoid fever. (‘Savory on Life and Death,’

p. 196.) According to Küssmaul, when the muscular system is powerfully developed and death is sudden, rigidity may not occur for sixteen or seventeen hours, and the shortest period within which it may occur and pass off in such cases, is about ten hours after death; but under certain circumstances it may continue for fourteen days or even longer. In a case in which I was consulted, a stout muscular man died suddenly from an attack of apoplexy. His body was exhumed and examined three weeks after death in the month of January. It was in a good state of preservation, and the limbs were so rigid that it required a great degree of force to bend them. No doubt in this case the cold favoured the continuance of rigidity.

The following case related by Dr. Chowne, shows the rapid access of cadaveric rigidity in a child, as well as its occurrence in a dead body before the entire loss of animal heat. This gentleman was called to a labour, and when he arrived, the child had been born about three quarters of an hour, and the midwife was then engaged in dressing it. One arm was a little raised and the hands were partly closed—these circumstances giving it the appearance of being a living child. He found, however, that it had actually been stillborn, and that it had been part of the time in a warm bath. The other limbs were also stiff in about the same degree. The stiffness was unequivocal, there was no elasticity, as if it was the result of spasmodic muscular contraction:—a joint being flexed, it remained flexed. The midwife particularly observed the stiffness while the child was in the warm bath. The mother said the child moved, very perceptibly to herself, not long before its birth. Whether the skin was hot or cold is not stated, but the body of a child cools very quickly. It is probable, from the midwife's statement, that the rigidity came on immediately or very soon after death. Sommer placed the bodies of wo infants, which had died asphyxiated, in tepid baths at from 90° to 99° mmediately after birth, and left them there. In between three and four ours rigidity was developed, and had attained its height in six hours. In leven hours the rigidity of the lower jaw had disappeared.

I observed in a cat which had died from disease, that the body and limbs ecame perfectly rigid about an hour after death, while warmth was still very reat throughout. The bodies of birds generally become rigid before they ool. I have also remarked, in animals poisoned by prussic acid, where conulsions ensued, that they died in violent muscular spasm, with the limbs nd tail perfectly rigid while the body was warm. This last condition, hower, corresponds rather to what has been called cadaveric spasm than adaveric rigidity. The difference between these two states will be a subject r after-consideration.

Cæteris paribus, rigidity is always more strongly manifested and continues r a longer period, in those bodies in which the muscular system is healthy nd fully developed. It has been observed, that the time at which it appears ter death in muscular subjects, is longer than in other cases, so that it may ot supervene for twelve or fourteen hours, and it may last for twenty-four or irty-six hours. Rigidity is said to be slow in manifesting itself, in death om hæmorrhage, irritant poisoning, apoplexy, wounds of the heart, decapitaon, as also in all cases of asphyxia, especially in death from hanging, or om the action of carbonic acid. In a remarkable case of suicide from a al wound in the throat, observed by Dr. Handyside, the rigidity of the uscular system commenced while the body was yet warm, and was complete *one hour and a half* after death. This early occurrence of rigidity cannot referred to any influence produced on the muscular system by loss of ood. In a case of death from hæmorrhage, in which four pounds of blood re suddenly lost from the axillary artery, it was observed that eight hours er death, the arms and legs were pliant; and it was not until twelve hours after death, when the body was becoming cold, that rigidity manifested itself. Death by hæmorrhage, therefore, does not accelerate this condition; it appears to have no more influence upon the period of its occurrence, than it has upon the cooling of the body (see page 7). So with regard to irritant poisoning in an acute form; no difference was observed in reference to the rate of cooling or the commencement of rigidity in a well-marked case of death from arsenic in eleven hours. In a case of suffocation by charcoal vapour, Nysten observed that rigidity did not make its appearance until *sixteen* hours after death, and it is stated to have lasted for the long period of *seven* days. In other instances of suffocation, this protraction of cadaveric rigidity has not been noticed.

In these cases, the slow access of this state depends less on the mode of death than on the irritability of the muscles at the time of death. This is always great when the nutrition of the muscles is perfect, a condition which exists in cases of violent death, as from decapitation, sudden hæmorrhage, or some form of asphyxia. Dr. Symonds has seen a body in a state of rigidity eight days after death by hanging. Nysten found that there was muscular irritability in the body of a decapitated man, twenty-six hours after the head had been severed from the body; and Brown Séquard states as the general result of his experience, that in the bodies of healthy persons decapitated or asphyxiated, cadaveric rigidity did not appear sooner than ten or twelve hours after death, and that it lasted more than a week even when the weather was warm. He has found in the muscles of the limbs of two decapitated men, some degree of irritability thirteen and fourteen hours after death.

Atmospheric changes appear to modify considerably the duration of this state. Dry and cold air will cause it to persist for a long time; and thus it is, that during the winter season, especially in a frost, it is slow in disappearing;—its mean duration being then from twenty-four to thirty-six hours. If the air is warm and saturated with humidity, it soon ceases. Temperature appears therefore chiefly to affect its duration and intensity. Sommer found that, other things being equal, bodies became rigid as quickly in an atmosphere of from 59° to 63° as in one from 77° to 81°; but that the bodies of strong persons continued rigid for eight or ten days at a temperature of from 36° to 45°, while it totally disappeared in from four to six days when they were exposed to a temperature of from 65° to 86°. Bodies sunk in cold water soon pass into this state, and retain their rigidity for a long time. Water is a better conductor of heat than air, and tends to retard putrefaction. The contracted state of the skin known as *cutis anserina* is sometimes observed in a recently-drowned body.

According to Nysten cadaveric rigidity first appears in the muscles of the trunk and neck; it then takes place in the muscles of the upper extremities, and lastly in those of the lower. In regard to its disappearance, the muscles of the lower extremities will often be found rigid, while those of the trunk and upper extremities are again in a state of relaxation. It appears later and lasts longer in the lower extremities, than in other parts of the body. If Nysten's theory were true, that rigidity depended exclusively on the mere loss of heat, it should appear first in the lower extremities, and last in the trunk. His own observations, therefore, respecting the order of its disappearance are against his theory.

Later observers have to some extent corroborated Nysten's statements regarding the commencement and diffusion of rigidity. Thus it begins almost always in the neck and lower jaw. Sommer found only one exception to this rule in examining two hundred dead bodies. From the neck it passes in two directions: upwards to the muscles of the face, and downwards to the muscles of the upper extremities and trunk,—then attacking those of the lower extremities. In the particular limbs, it commonly proceeds from above downwards, and it generally passes off in the same order. It always sets in, increases, and decreases imperceptibly and gradually, in which respect it differs strikingly from the rigidity of muscles as a result of disease. ('Küssmaul, Vierteljahrschrift für die praktische Heilkunde, 1856.' B. 2, s. 67. See also a translation by Dr. Moore, 'Dublin Quar. Jour. Med. Sci.' 1856, vol. 22, p. 490.)

It will now be necessary to consider whether a living body ever assumes a condition analogous to that of cadaveric rigidity. Tetanus, apoplexy, catalepsy, hysteria, syncope, and asphyxia, have been stated to present symptoms which might lead to doubt respecting the reality of death from this sign. There are, however, these striking differences. In rigidity from any of these diseases, the warmth of the body is commonly in great part preserved, if not on the surface, in the rectum and flexures of the joints. The rigidity of disease takes place simultaneously with the apparent suspension of life from the attack; and lastly, the whole of the body becomes equally rigid at the same moment, owing to the existence of a universal muscular spasm. In order to distinguish this state of spasm in a really living member from the rigidity of death, it has been recommended to bend it forcibly; if it be in a state of spasm from disease (tetanus), it will return to its original position so soon as the bending force is removed; if it be in a state of cadaveric rigidity, the limb will not return to its position, but may be afterwards moved in any direction. If rigidity was at the time fully developed, the muscle will not again become rigid; if, however, rigidity was only commencing, then the limb will again resume its rigid condition, but slowly. (Sommer.) This is the main distinction between rigidity in a living and in a dead body. In real death, however, other unequivocal signs will be present. Rigidity takes place in the muscles of the countenance as well as in those of the body. It is important to bear this in mind, since identity may be mistaken when a corpse is seen about this period. The expression of the countenance, as of anger, pain, or terror, at the moment of death, depends on the contraction of the facial muscles. After death these, like other voluntary muscles, undergo relaxation, and the face assumes a placid appearance; but as rigidity manifests itself, there is sometimes a remarkable change of expression. The face is pale or sallow, the jaws are fixed, the corners of the mouth are drawn downwards, the temples sunk in, and the brow contracted. Even those who may have known a person well during life, would scarcely recognize him at this time, were they to see the body in a strange locality. Dr. Snow was once called to see a young woman after she had been dead three days, whose face had suddenly become so suffused and red, that her friends doubted the reality of her death. After a time, however, the colour abated, and the commencement of putrefaction clearly proved that she was dead. ('Medical Critic,' January 1863, p. 26.) I have witnessed a similar appearance in a corpse; the cheeks acquired a lorid red colour between the third and fourth day after death, when rigidity had ceased. It is supposed that this colour is due to the action of the oxygen f the air on the blood forced into the capillaries by incipient decomposition. t is hardly necessary to observe that this appearance, coupled, as it is stated o have been in some cases, with a slight degree of warmth, could not give rise o any mistake about the date of death, since the rest of the body would be old, and in death which is really recent, the face becomes cold before the kin of the chest and abdomen.

According to Dr. Symonds, the kind of death always has a great influence n the expression of the countenance. On fields of battle, the corpses of those ho have died of stabs are easily distinguished by the countenance from hose who have fallen by gunshot. In the former, an extremely painful impression must have been transmitted to the brain, which produced the usual change in the nerves and muscles of expression; in the latter, concussion was given to the whole system, paralysing, without any intermediate sensation, so that no expression remained more than that of the repose of the muscles. ('Cyc. Anat. and Physiol.,' Art. Death.)

The involuntary muscles are subject to cadaveric rigidity as well as the voluntary, and by reason of the more speedy loss of muscular irritability, it appears in them more rapidly. The ventricles of the heart commonly lose their irritability within an hour after death. They become rigid, and remain in that state for ten or twelve hours, sometimes for twenty-four or thirty-six hours, then again becoming relaxed or flaccid (Carpenter). Duval saw the heart of a criminal a quarter of an hour after decapitation, beating with great distinctness. The left auricle in particular exhibited strong and regular action, forty-four times in a minute, and continued to do so for an hour. ('Prov. Med. Journ.,' September 1851.)

At a certain period after death, the heart becomes rigid and firmly contracted. If examined at this time, it may appear to be in a state of spasm and to have its walls thickened, while the cavity of the left ventricle may be described as being much smaller than in the normal state. Mr. Paget has pointed out that this natural condition of the heart after death has led to pathological mistakes, the walls being described as thickened and the cavities being diminished in size, and the heart itself as being in a state of concentric hypertrophy from disease. On the other hand, the perfect relaxation of the heart which follows at a later period after death, has been mistaken for and described as a morbid flabbiness and flaccidity. Spasm and paralysis cannot be inferred to have existed when we discover these conditions of the heart in the dead body.

The observations of M. Brown Séquard have furnished an explanation of many of the difficulties connected with the occurrence, duration, and disappearance of cadaveric rigidity. ('On the Relations between Muscular Irritability, Cadaveric Rigidity, and Putrefaction.' 'Proc. R.S.' May 1861, p. 204.) This physiologist agrees with Nysten and others that the greater the degree of muscular irritability at the time of death, the later cadaveric rigidity sets in, and the longer it lasts; and the later also putrefaction appears, and the more slowly it progresses. Müller and Gierlichs had already shown that rigidity does not occur until the muscles have lost their irritability, or their power of contracting on the application of ordinary stimuli; that in frogs, in which, as in other reptiles, muscular irritability is very persistent, rigidity is often not established until three or four days after death; that in birds, on the other hand, in which muscular irritability remains but a short time after death, rigidity ensues quickly. Further, all circumstances which cause a speedy exhaustion of muscular irritability during life, induce an early occurrence of cadaveric rigidity, while those conditions by which the appearance of irritability is delayed, retard its access. ('Baly and Kirke's Physiology,' 1848, p. 9.) M. Brown Séquard observed as a result of his experiments on animals, that when the temperature of the muscles was diminished before death, their irritability lasted long after death; cadaveric rigidity set in late, and lasted long; and putrefaction appeared late and proceeded slowly. Whatever exhausts muscular irritability, such as violent exercise or exertion, accelerates rigidity in the dead, and, in an equal degree, putrefaction: this applies to observations on man, as well as on animals. Rigidity takes place rapidly in the dead bodies of cattle that have been overdriven, or of animals that have been hunted to death. The bodies of soldiers killed in the early part of a battle become rigid slowly, while the bodies of those who are killed at the close, after many hours of violent muscular exertion, become rigid almost immediately. This may explain the singular fact recorded by military men.

that the bodies are sometimes found on the field of battle stiffened in the attitude of kneeling or sitting, with their weapons clenched firmly in their hands (page 22). There has been no relaxation in death, but the muscles appear to have at once passed from a living contraction into a rigid condition. This also throws light upon a fact to be presently noticed (page 24), that suicides are sometimes found with weapons grasped in their hands, and their bodies stiffened in the attitudes in which they have died. It may be inferred in these cases that, from some cause operating during life, the muscular irritability was exhausted at the time of death. Hence the greatest differences are observed to exist in regard to cadaveric rigidity and putrefaction, in consequence of the variable degree of muscular irritability at the time of death.

The effects of strychnia and other poisons which produce convulsions may be explained by reference to their action on the muscles. Rigidity has been observed to set in with great rapidity in animals destroyed by strychnia or veratria. Küssmaul made a similar observation in reference to the action of coal-gas on the system. Brown Séquard noticed that when death was produced almost at once by these poisons, or by others having a similar mode of action, *e. g.* atropia, morphia, oxalic acid, and cyanide of mercury, there was hardly any effect observed on the time of access and duration of rigidity and putrefaction; but when convulsions had existed for a long time before death, the influence was most remarkable. He poisoned three healthy dogs, as much alike as possible, with the acetate of strychnia. One of them had a dose of two grains, another of half a grain, and the third of one-fourth of a grain. The first dog died at once; the second after twelve minutes, during seven of which it had convulsions; and the third after twenty-one minutes, during eleven of which it suffered from convulsions. The following are the tabulated results in reference to the duration of muscular irritability and of cadaveric rigidity, as well as of the occurrence of putrefaction:—

	Durat. of musc. irrit.	Durat. of cad. rigid.	Putrefaction.
1st dog . . .	8 hours . . .	19 or 20 days . . .	slow
2nd dog . . .	$2\frac{1}{2}$ ” . . .	5 days . . .	rapid
3rd dog . . .	$\frac{1}{2}$ ” . . .	less than a day . .	very rapid

In other animals which were killed by poisons causing convulsions, the more violent and frequent the convulsions were, the sooner cadaveric rigidity set in; and the shorter the time that it lasted, the sooner also did putrefaction appear, and the more rapid its progress. In reference to my own experiments, a rabbit died from the effects of half a grain of strychnia in twenty-three minutes; during the last eleven minutes it had several fits of convulsions, and died in one of these. In ten minutes after death, rigidity showed itself in the hind legs, and rapidly spread throughout the body. The rigidity had decreased in two days, and had nearly disappeared in four days. ('Guy's Hosp. Reports,' Oct 1856, p. 112.) In the body of a strongly-built woman, who died of hydrophobia after violent convulsions, Brown Séquard found that cadaveric rigidity had set in within the first hour after death, and that it had ceased before the end of the tenth hour.

Although, according to Nysten, the later the time at which rigidity commences the longer it lasts, yet it does not necessarily follow that when it speedily supervenes after death, it will rapidly disappear. There are many facts which show that when the muscles are strongly contracted at the time of death, they become rigid in this contracted state, and remain rigid for many hours, and even days.

The rigidity produced as a result of poisoning by strychnia, may sometimes continue for a very long period. Thus, in the case of *J. P. Cook* (Reg. v. Palmer, 1856), the body, when examined on the sixth day after death, was in a state of rigid spasm, and the members were found in a similar state on the exhumation of the body two months afterwards. It is worthy of remark that Cook lived only twenty minutes after the symptoms first appeared. He suffered from a few convulsive fits, but not sufficient to exhaust the irritability of the muscular system.

These facts have an important bearing on cases of poisoning by strychnia and other spinal poisons. The state of the dead body will vary according to the rapidity of death, and the degree of exhaustion of muscular irritability at the time of death, as a result of the fits of convulsions produced by the poison. They also show that when, from whatever cause, muscular irritability at the time of death is slight, either in consequence of a bad state of nutrition or of exhaustion from over-exertion, or from convulsions caused by disease or poison, cadaveric rigidity sets in and ceases soon, and putrefaction appears and progresses quickly. (Brown Séquard, 'Proc. R.S.,' May 1861.) For a similar reason it takes place at an earlier period in the very young and the old, than in an adult at the prime of life.

It has been long observed that the bodies of those who are emaciated, or who die from debilitating diseases, such as phthisis, typhus or typhoid fever, and malignant cholera, pass rapidly into a state of rigidity, which is commonly of short duration. Hence, owing to want of correct observation, it has been erroneously stated that cadaveric rigidity did not occur in such cases. In reference to deaths from malignant cholera, Brown Séquard observed, that cadaveric rigidity appeared late and lasted long in those patients who died quickly, that is, before a prolonged alteration of nutrition, and that those muscles which had been attacked with violent and frequent cramps, became rigid very soon after death, and remained so only for a short time. M. Ollivier found that the bodies of cholera patients were frequently rigid in from six to eight hours after death, while the muscles which were the seat of this rigidity were still warm, and on making an incision into them, the blood readily flowed out. A similar error has arisen respecting the bodies of persons killed by lightning. John Hunter thought that cadaveric rigidity did not occur in this mode of violent death; but the late Sir B. Brodie found that the body of an animal killed by electricity became, as usual, rigid after death. In an accident which occurred in France, in August 1846, a group of labourers was struck by the electric fluid: four were killed on the spot, and five or six severely wounded. It was remarked that the person whose body bore the most extensive marks of injury had worn a goat-skin. There were several lacerations about this body, and in three hours after death it became perfectly rigid. ('Med. Gaz.,' vol. 38, p. 351.) In a case of death from lightning, communicated to the 'Medical Gazette' by Dr. F. J. Brown, rigidity was strongly marked in the limbs about twenty-eight hours after death (vol. 47, p. 844). In May 1854, during a storm, a man was struck by the electric fluid. He made a short exclamation, and immediately expired. It was observed in this case that the body became rigid after death.

Facts are now sufficiently numerous to enable us to say that the old opinion of the non-occurrence of rigidity in the bodies of persons killed by lightning is unfounded. Dr. Bagot, of Ballingarry, has informed me that, in a case which he examined in the summer of 1855, the body of a man, æt. 28, who had been killed by lightning, was as rigid twenty-eight hours after death as if death had taken place from any other cause. The researches of Brown Séquard afford a satisfactory explanation of the differences among physiologists upon this question. In some instances, no doubt, cadaveric rigidity has set in, and has been of such short duration, that it has not been possible to ascertain its existence. Death by lightning may be the result 1st, of syncope by fright, or in consequence of a direct or reflex influence of lightning on the par vagum; 2ndly, of hæmorrhage or bleeding in or around the brain, the lungs, or pericardium; and 3rdly, of concussion, or some other change produced by the electric fluid on the brain and nervous system. When death by lightning is due to any one of these causes, cadaveric rigidity may appear and run through its course rapidly, as in some other cases of sudden death. But lightning may destroy life like a powerful galvanic shock, by producing such a violent convulsion of every muscle in the body that muscular irritability ceases almost at once. The rigidity in this case may be of such short duration as entirely to escape notice. Allowing for the difference in the relative power of lightning and galvanism, the greater effect of the former may reduce the duration of muscular irritability to the fraction of a second, and that of cadaveric rigidity in a corresponding degree, so that no trace of it may remain even a few minutes after death (op. cit., p. 209). Ranke has made the curious observation, that there is a difference in the conducting power of living and dead muscle, in reference to electricity. Contrary to that which might have been anticipated, he found that dead muscle was a much better conductor than living muscle; and he traced this increase in conducting power to the presence of certain products of decomposition which do not appear until after death.

It has been observed, as a general rule, that cadaveric rigidity does not affect the relative position of the parts to which the muscles are attached; but a peculiar condition of the *hands* of the dead, observed by M. Villermè, would tend to show that in dying, the fingers assume a certain position by virtue of the contraction of the flexor muscles connected with them; although it is not quite established, whether this contracted state of the fingers takes place at the same moment with the commencing rigidity of the body, or whether it is not an immediate consequence of dissolution. M. Villermè has remarked, that in a dead body, the thumbs are always bent inwards towards the palms of the hands, the apex of the thumb being opposite the base of the little finger; and the thumb itself being covered by the four fingers of the hand. M. Villermè found this condition in many dead bodies which had not been disturbed. Devergie supposes that this position of the thumbs depends on a convulsive action of the fingers at the last moment of life; and as death may take place without any convulsive action, the appearance may be in some instances wanting. This sign of death, if it can be so called, is of but little importance; it will, however, be found in a large number of cases where there has been no interference with the hands. ('Ann. d'Hyg.' 1830, 2, 420.)

There is another condition of the *hand* in the dead which calls for notice. If the hand of a living person is held before a strong light, it will be found to be translucent, and of a deep red colour from the blood circulating through it. The hand of a really dead person thus examined is stated to be in all cases opaque. In applying this as a test, we must remember that a horny or hardened state of the cuticle, or a diseased condition of parts, may interfere with this translucency in the living subject: it is always better seen in the young and in those whose hands are thin. In these cases the fingers appear to be formed of a mass of blood: they have a deep red tint, except about the joints, where the colour appears lighter.

The Eyes.—Shortly after death, the cornea becomes dull, its brightness and prominence disappear, the globe becomes collapsed, and, after a time, the surface of the membrane is wrinkled. Louis long since observed, that the eyes of he dead became flaccid and soft in a very few hours after dissolution, and that film was formed over them; this condition he considered to be characteristic of death. It is necessary to observe, however, that while this appearance is not always met with in the dead body, it is sometimes found in the living. n those who have died from apoplexy, or from the inhalation of carbonic acid gas, the eyes have often preserved their brilliancy and prominence for a length of time. This has also been observed in those who have been poisoned by prussic acid, cyanide of potassium, or the essential oil of bitter almonds. Incipient putrefactive changes may, by forcing the blood towards the head, cause a prominence and brilliancy of these organs, in those bodies in which they were dull and collapsed soon after death. On the other hand the film over the eye and the collapse of the globe have been observed in cases of malignant cholera several hours before death, and while the heart was still beating. ('Ann. d'Hygiène,' 1848, 1, 104.) Küssmaul has noticed in reference to the eyes, that no conclusion can be drawn, from the width of the pupils in death, as to the diameter which they presented at the latest period of life. This statement is of some practical importance in reference to post-mortem appearances in cases of alleged narcotic poisoning. M. Ripault noticed that in real death, the iris is perfectly flaccid. This is seen when the globe is compressed in two opposite directions at the same time. If the person is living, the pupil retains its circular form, notwithstanding the compression. If dead, the circular form is lost, and the aperture becomes irregular. Dr. Fleming has noticed that a solution of atropia, which by causing dilatation of the pupil would reduce the living iris to a mere line, has no action on the iris of the dead eye; but the result probably depends on the time after death at which the liquid is applied. Jobst and Hesse found that two drops of an aqueous solution of phytostygmia (the poisonous alkaloid of the Calabar bean) applied to the eye of a rabbit an hour after death from natural causes, caused the pupil to contract to one-fourth, compared with the other eye, and it remained in this condition. ('Chem. News,' March 5, 1864, p. 109.)

The Skin.—After dissolution, the skin is observed to become extremely pallid and waxy-looking, owing to the absence of all circulation. In some parts it becomes covered, as the body cools, by livid discolourations (cadaveric ecchymosis); this is especially the case in those instances where death has taken place by sudden violence. One of the most striking changes in the skin is its entire loss of elasticity. In the living body, if any part of the surface be compressed, the skin will readily return to its original form on removing the pressure. Thus, in a doubtful case, a flatness of those parts which have been allowed to lie upon an even surface may be regarded as a sign of real death, provided the other concomitant changes are observed. It is almost unnecessary to remark, that if certain diseases have the power of depriving the skin of its elasticity, the history of these cases, or a superficial inspection of the body, will suffice to show to what cause this want of elasticity is to be attributed.

Among the signs of death has been enumerated *coagulation of the blood.* M. Donné suggested that, in order to determine the reality of death before the access of putrefaction, a small portion of blood should be drawn from a vessel, and it should then be observed whether it coagulated or not. If instead of a red homogeneous *coagulable* liquid we obtain only a reddish-coloured uncoagulable serum, from which the particles speedily subsided as a red sediment, we shall be justified in inferring that life has ceased—a conclusion at which we could not arrive if even the smallest portion of coagulum should be formed. This appears to be a fair physiological test, and easy of application. When the blood has once coagulated, there must be an arrest of circulation; and although it might become again fluid, this would be only under the influence of putrefaction, and it would not thereby recover a coagulating power. One of the great characters of blood effused from a *living* body is, that it coagulates speedily after its effusion. Thus, drops from an artery thrown on furniture or a wall speedily consolidate, assuming an oval or long elliptical form, the narrow point downwards, and at this part will be found the coagulum of fibrin locking up the red colouring matter. Blood sprinkled from a dead body is more liquid; it forms a long irregular drop or streak, and only dries up by evaporation; it has no coagulating property.

The blood coagulates in most cases after death, but at a variable time after the cessation of the heart's action. When blood is removed from the living body, coagulation commences in from five to ten minutes. In the dead body, it probably does not commence until it begins to cool. Hence the fact of coagulation does not prove that the person is living. Dr. Wilks has observed that when a body is examined eight or ten hours after death, it is not unusual to find the blood which may have flowed from it as a liquid, forming a firm clot on the table; and that which is effused into the chest during the examination often forms after some time a very firm coagulum. ('Guy's Hospital Reports,' Oct. 1863, p. 183.)

It has been stated that the blood of persons killed by lightning does not coagulate, but this statement is erroneous. Certain diseases appear to influence the coagulation of the blood. Mr. Savory has observed that coagulation has been partial or imperfect in cases of death from delirium tremens; and it is well known that in rapid death from certain vegetable poisons the blood is found fluid and of a darker colour than natural, even when the examination is made soon after death.

CHAPTER 2.

CADAVERIC SPASM—EVIDENCE OF MURDER, SUICIDE, OR ACCIDENT FURNISHED BY THE POSITION OF A DEAD BODY—WEAPONS FOUND IN THE HANDS—MUSCULAR IRRITABILITY—TESTS OF ITS PRESENCE—POST-MORTEM CONTRACTILITY—ALLEGED PREMATURE INTERMENTS—PROOFS OF THE REALITY OF DEATH—DEATH-TRANCE—APPARENT DEATH IN THE DROWNED AND IN NEW-BORN CHILDREN.

In reference to persons found dead, the position or attitude of the body, if undisturbed, may often throw an important light on the mode of death, and on the question whether the deceased had died by his own act or by the act of another.

Cadaveric Spasm.—It has been already stated that, as a general rule, the muscular system passes into a state of relaxation at the moment of death. This is observed in cases of tetanus of a severe form, whether produced by disease or by poison. Half a grain of strychnia was given to a rabbit. After several fits of convulsions the animal died; respiration ceased in twenty-three minutes. At this time there was perfect flaccidity of the body, limbs, and points; but this condition lasted but for a very short period. The animal was placed on its back, and the legs raised, for the purpose of making an examina-tion of the chest. In ten minutes the body became, while still warm, per-ectly rigid in the attitude in which it was held—the fore-legs remaining tretched upwards and wide apart. If an animal dies in a convulsion, and he body is not disturbed, the tetanic spasm may pass rapidly into cadaveric igidity. This has been called tetanic rigidity, but it is in fact cadaveric gidity or muscular spasm showing itself in a persistent form after death. When the rigid state is destroyed by forcibly bending a joint, the limb will ot return to its position like that which is contracted by a tetanic convulsion. ngel has seen this transition from spasm to rigidity; and I have noticed, in xperiments on animals, a rigid condition assumed after death without any pparent relaxation of the muscles. Sommer and Clemens have observed, in tal cases of rheumatic tetanus, that the spasm of the muscles of the jaw, neck, nd back passed immediately into cadaveric rigidity. (Küssmaul, loc. cit. 490.)

That spasmodic condition of the muscles which passes into rigidity in death from tetanus, may also show itself in other cases of strong muscular contraction at the moment of death. Thus a body may stiffen or become rigid in an attitude of attack or resistance; the members may retain in a rigid state that position which the last act of volition imparted to them. The term cadaveric spasm has been applied to this condition of the muscles: it is nothing more than muscular rigidity or violent muscular contraction so rapidly followed by the rigidity of death, that the muscles have not relaxed on the cessation of life.

M. Marc first directed the attention of medical jurists to this subject in reference to a case which will be hereafter related. He considered that this form of rigidity might occur as a result of sudden death from apoplexy, and he quotes the following case as an illustration:—An aged man, while at the theatre with his family, rested his forehead upon his hands, which were crossed in front of him, while with his elbows he leaned on the front of the box. It was thought that he had gone to sleep in this attitude, and he was not disturbed; but after the performance was over and the persons were about to leave the theatre, it was found that he was quite dead. ('Ann. d'Hyg.' 1832, 1, 602.) I knew an instance in which a lady who had retired to her bed-room in perfect health was found dead the following morning. She was kneeling at a chair in the attitude of prayer, and her body had become rigid in this position. This was also a case of sudden death from apoplexy. In some instances in which chloroform vapour has caused accidental death, the hand firmly grasping the handkerchief has been found applied to the mouth and nostrils, as if the deceased were still breathing the vapour.

From what has been elsewhere stated (page 17), this singular condition of the body is more likely to present itself in those cases in which there has been great muscular exertion, and muscular irritability is nearly exhausted at the moment of death. Corpses have thus been seen stiffened on the battle-field in the last attitude of life. Mr. Russell thus describes what he saw after the battle of the Alma in the Crimean war:—'The attitudes of some of the dead were awful. One man might be seen resting on one knee, with the arms extended in the form of taking aim, the brow compressed, the lips clenched, the very expression of firing at an enemy stamped on the face, and fixed there by death: a ball had struck this man in the neck. Another was lying on his back, with the same expression, and his arms raised in a similar attitude, the Minié musket still grasped in his hands, undischarged. Another lay in a perfect arch, his head resting on one part of the ground and his feet on the other, but the back raised high above it.' Cases of a similar kind were noticed in the Italian war after the battle of Solferino, and in some of the battles in North America between the Federal and Confederate States. (See 'Savory on Life and Death,' p. 192.)

In cases of sudden and violent death, it is by no means unusual to find the body, or one or more of the limbs, rigid and fixed in a state of spasmodic contraction. This is sometimes witnessed in cases in which persons have died in full and robust health. The body of a suicide may be discovered stretched on the floor of an apartment, with the suicidal weapon firmly grasped in his hand. Razors and pistols are thus frequently found in the hands of suicides, whether recently dead, or whether they have been lying some time before they were discovered; and these instruments may be grasped or held under circumstances which would appear impossible, from their weight, were it not well ascertained, that the spasm which often ensues at the moment of death may be retained for a considerable period. In Sept. 1836, a gentleman was found dead in a chair in his bed-room; he had shot himself some hours before his body was discovered. A discharged pistol was still held firmly in his right hand, and there was also a loaded pistol grasped in his left. Instances are frequently occurring, in which razors or knives require to be removed, even with some force, from the hands of those who have destroyed themselves. In such cases, the contractile power, impressed by the last fatal act of volition, persists until cadaveric rigidity has supervened.

Devergie observes, that, although in many cases the arms, at the moment of death, fall in a collapsed state by the sides of the body, there are numerous others in which their situation may throw some light on the manner of death. In one case of suicide by a pistol-shot, he found on entering the apartment, the right arm and hand of the deceased turned towards the side of the head, against which the pistol had been fired. A man, who had died from the effects of carbonic acid given out by a limekiln, was found with the left arm raised and supporting his head, the right semiflexed on the abdomen; the whole figure being that of a person quietly asleep.

These are curious facts, and deserve to be borne in mind, for questions relating to them arise unexpectedly on trials for murder. Although apparently trivial, they may in some instances become the turning points of the guilt or innocence of a person charged with murder.

In the case of *Lord William Russell*, who was murdered by Courvoisier in 1840, it was observed that one hand of the deceased firmly grasped the sheet of the bed, as if in a struggle against an assassin. The force here given to the muscles during life, had persisted after death: it had passed into what has been termed, for want of a better designation, 'cadaveric spasm,' and in this state, the contracted hand had become rigid. This position of the hand of deceased furnished, among other circumstances, some evidence against the presumption of suicide. In drowning, it is by no means unusual to find, when the dead bodies are taken from water soon after the accident, that pieces of rope, an oar, grass similar to that growing on the banks, or weeds like those growing at the bottom of a canal or river, are firmly grasped in the hands. This is one of the strongest proofs which we have that the individual has gone into the water living. Part of a dress may be thus found grasped in the hand, and serve to identify a person accused of murder.

In general, when the dead bodies of the recently-drowned are taken from water, the limbs are found relaxed; but this depends on the period at which they are removed. Convulsions sometimes precede death by asphyxia, but the effects of these on the body are generally lost when the person dies. Rigidity of the muscles takes place after death in water, perhaps more rapidly than in air. If the water is intensely cold, and the person has struggled violently, the last struggles of life may be indicated by the contorted state of the limbs persisting through rigidity. Mr. Beardsley, a former pupil, communicated to me the following case. A young man, while skating, fell through the ice of a pond about seven yards deep. This was in February 1847. He was not totally immersed, for he kept his head and shoulders out of the water above the ice, with his arms resting upon it; and as the ice gave way under his weight he sprang to a fresh portion. Before assistance could be rendered, he sank. The body was recovered the next day; it was found at the bottom of the pond, beneath the hole in the ice. The arms of the deceased were stiff, and still retained the position in which he had rested upon the ice: his legs were quite extended, and the muscles on the fore part of the thigh were very much contracted, as if they had been powerfully exerted in keeping him erect while he was hanging on the ice. There was no appearance of his having attempted to breathe, after he had gone below the water. His countenance was quite natural, and there was no water or froth in his mouth; the external appearances resembled those which are seen in a body immersed after death from some other cause. There was no internal inspection. Mr. Beardsley's opinion was, that the water being about 32°, the man was in reality killed by cold, or frozen; and there is no doubt, that if this did not operate as the direct cause of death, it materially accelerated it.

This case is of interest in reference to the fact of the bodies of persons who have been drowned at the same time, by a common accident, being frequently found clasped in each other's arms. A contracted state of the muscles at the time of death may pass into perfect rigidity by the effect of cold water: and thus the attitude, or the last act of life of the individual, may be preserved.

The deceased may be found with some article grasped in the hand. (See case, 'Ann. d'Hyg.' 1829, t. 1, p. 464). It may be the hair of the deceased or the prisoner's hair torn off in the struggle for life; and on this point an important question of identity may be easily raised. (Reg. *v.* Ellison, Bodmin Summer Assizes, 1845).

In a case which was tried some years since, a man was charged with the murder of a woman with whom he cohabited. The body of the deceased was found lying dead in the house, with such injuries about the head, as to render it certain that she must have been murdered. In her right hand, was found a considerable quantity of brown hair, and in the other hand some grey hair, grasped evidently in the struggle for life. The morning following the murder the prisoner went to a hairdresser's in the town, and desired to have his hair and whiskers cut. This man observed that the hair and whiskers had been recently cut, and evidently by some one unaccustomed to hair-cutting. There was a difference between the hair of the whiskers and that of the head, the former having turned grey. The hairdresser was of opinion, that the hair found in the hands of the deceased, was of the same colour and kind as the hair of the prisoner. This, with other corroborating circumstances, led to his conviction. In a case which occurred to Dr. Marc, a woman was found assassinated in her house, and when the body was discovered, a small snuff-box was still held firmly in one hand. This proved that the murder must have taken place very suddenly, and without any resistance on the part of the deceased. ('Ann. d'Hyg.' 1829, t. 1, p. 465.)

Great light is often thrown upon a question of suicide or murder by attention being paid to these minute points connected with a dead body. Weapons, such as pistols or razors, are often found forcibly grasped in the hands of persons who have destroyed themselves; and when a weapon is thus found, the fact is strongly confirmatory of suicide. It does not seem possible that a murderer could simulate this condition after destroying the deceased. The hand of a dead person, while still warm and pliant, could not be made to grasp a weapon in the same way as that hand which had firmly held it by powerful muscular contraction at the last moment of life. At any rate, the attempt to produce this appearance has signally failed. At the trial of a man named Saville, in 1844, it came out in evidence, that the deceased, his wife, was found dead with her throat severely cut, and there was a razor, not grasped, but lying loosely in her hand. There was no blood upon the hand which held the razor, and this, together with the fact of its being loose, rendered it certain that the weapon had been placed there by some person, after the throat of the deceased had been cut.

The case of the woman *Gardner* (Reg. *v.* Gardner, C. C. C., Oct. 1862) was marked by a similar incident. The woman had died from several wounds in the throat which could not have been self-inflicted, and a common table-knife was found loosely lying in her right hand, with the back of the blade towards the palm of the hand, and the weapon in the direction of the length of the body. According to the evidence of the medical witnesses, the principal wound in the throat, was of such a nature that it could not have been inflicted with the right hand. This at once proved that there had been murderous interference. On these occasions it may be suggested that a weapon, although grasped by an alleged suicide to inflict the death-wound, may either drop from the hand or be found loosely in it, as a result of the relaxation of the muscles in death. This must be admitted; hence the mere fact of a weapon being found loose, should not be taken as evidence of murder, unless other circumstances—such as the nature of the wound, the freedom of the hand from blood, the position of the body, &c.—concur to prove that the act was not one of suicide. Küssmaul asserts that the fact of a weapon, whether a razor, knife, or pistol, being found firmly grasped, should not be taken as any proof of suicide; because if this position be given to the fingers when in the stage of relaxation, they will in that of rigidity, embrace the article so closely, that it will be difficult to disengage it. He gives this as a mere surmise, and not as being based on any experiment. That it should present itself as a serious objection in practice, we must infer that assassins are fully aware of the forensic necessity of causing the hand of the victim to grasp the weapon with the greatest firmness, and that they can remain by the corpse thus holding the hand clenched, until the fingers have stiffened with sufficient firmness to retain it! Assuming this improbable state of things, other circumstances, as in Gardner's case, may show that the weapon after all has been placed in the wrong hand, or that the blood-marks on it and on the hand, have no correspondence. The difficulty of thus endeavouring to imitate on act of suicide, when the facts are properly observed and compared, will be apparent from the following case, which was tried at the Liverpool Assizes, 1855 (Reg. *v.* Heywood). The deceased in this case, a female, was found dead in bed with her throat cut. The medical evidence showed that the wound was six inches from right to left, extending across the throat to a point under the left ear: the upper portion of the windpipe was severed, and the jugular vein, as well as the muscular branches of the carotid artery, were divided. The medical witnesses considered that the wound in the throat had not been inflicted by herself. It was such a wound as a *left*-handed person would have inflicted, and the hand inflicting it, as well as the weapon, could not have escaped being marked with blood. It appears that when the body was found, there was a razor in the *right* hand, not tightly held. The arms were folded across the chest, the right hand resting on the left, the back of the razor being towards the person of deceased. There was *no blood* on the *hands*, arms, or chest, and only one small spot on the razor. There was blood on the under-side of a pillow, and a corresponding stain on the bolster, showing that this must have been turned over, and the head placed on the clean side after the infliction of the wound. All the circumstances concurred in showing, that an attempt had been made to simulate an act of suicide, while the facts were only consistent with homicide. The prisoner was connected with the act by the moral as well as circumstantial evidence, and he was convicted and executed.

Neither during nor after the cessation of rigidity could this spasmodic condition of the muscles of the hand be simulated; in no case, it appears to me, is it possible to give an appearance of grasping, similar to that which is occasionally found after death as a result of cadaveric spasm and rigidity.

It is strange that the discovery of a weapon thus held in a dead hand, should have been assumed to furnish evidence of murder. The following case is, in this point of view, worthy of notice. On July 5, 1835, a medical practitioner of Bordeaux was called to examine the body of a gentleman supposed to have been murdered. Upon entering the apartment, which had been left undisturbed, he found the deceased perfectly dead, sitting in an arm-chair by the side of the bed, the left elbow resting upon the bolster.

His right hand, which held a recently-discharged pistol, rested upon the middle of the right thigh, the greater part of the barrel projecting over the inner surface of the thigh, so that the slightest motion of the part, would apparently have been sufficient to cause it to fall on the floor. The bullet, which could not be found, had fractured and traversed the left parietal bone, after having torn off nearly the whole of the face. The clothes of the deceased were saturated with blood; a large quantity had also drained through the seat of the chair, and had formed a considerable clot on the floor. The temperature of the body indicated that the deceased had not been dead above two hours; and it was at about that time, that the discharge of a pistol had been heard by some of the neighbours.

The other facts ascertained relative to the case, were that the deceased, who was about sixty years of age, had never shown any disposition to destroy himself; and there was no moral circumstance which seemed likely to have acted as an exciting cause, except perhaps the loss of a law-suit by a favourite sister, which, however, was deemed scarcely sufficient to explain the event. He had a son, who lived in the house with him, and slept in the same room. They were both dissipated in their habits. On the morning of the event, after breakfast, the son (according to his own statement) threw himself on his bed, which was by the side of that of his father; he fell asleep, and knew nothing of the circumstance until he was roused out of his sleep by the discharge of a pistol. The son was accused of having destroyed his father, and of having placed the pistol in the hand of his parent after death, in order to lead to the supposition of suicide. This circumstance seemed so much the more probable to the police officers and those who were present at the finding of the body, since, when the hand with the pistol was carefully carried to the position, in which the weapon must have been held by the deceased in order to have committed the fatal act himself, and the hand was afterwards allowed to fall by its own weight, the pistol each time fell from the hand to the floor. Besides, on the moral side of the question, it was shown, that the son would be benefited by the death of the father.

The medical examiner having duly reflected on the position in which the deceased was discovered, satisfactorily accounted for the hand retaining the pistol after death by the contractile state of the muscles, from the effect of volition at the moment of death being sufficiently strong to prevent the weapon from falling. The experiments performed with the hand and pistol subsequently were very properly stated to be unsatisfactory; since, when this contracted state of the muscles has been once destroyed by much handling, it could not be restored. The specious argument thus founded upon a popular error, was by the tact of the medical witness satisfactorily refuted.

The reporter of the case candidly confesses that, owing to his having been misled by popular prejudice, he was at first almost inclined to believe that the son had been guilty of parricide; and probably if a hasty and careless examination had been made, or if the body had been officiously interfered with, previously to its being seen by a medical man, the son might have been committed for trial on the charge. So soon as this apparently physical proof of his guilt had been explained away, it was then seen, that all the other circumstances rebutted the presumption of homicide. The discovery of a weapon so held, is one of the best possible proofs of suicide.

The postures, in which the bodies of persons found dead from any cause, are discovered, may, in numerous cases, be brought forward to support a charge of murder, or, at least, of criminal interference: but great care is always required in the application of medical principles to the elucidation of these cases, as well as a good general acquaintance with the various phenomena immediately preceding and following death.

As the body becomes rigid in the position in which it happens to be on cooling, and assumes exactly the attitude of the person at the time of death, careful observation may, in some instances, show whether, in a case of violent death, it was or was not interfered with *before* rigidity took place. A question of this kind arose in the following case. The deceased was found lying dead in the room where the murder had been perpetrated; there were marks of blood in various places, and the body had evidently been removed from the spot where it had fallen: it had been laid out. The clothes had been tucked round it, and a piece of black cloth had been placed over the face. A question arose as to whether the body had been thus removed before or after rigidity occurred? As it was found evenly laid out, the probability was, that it had been removed while the limbs were pliant; and they had then become rigid in this position. If a body be removed during the state of rigidity, it may be in some instances indicated by the position of the still rigid limbs, not being adapted to the surface on which the body is found lying. It has been already stated that the first effect of death, in the absence of cadaveric spasm, is relaxation of the muscles; the body then disposes itself according to the surface on which it happens to be lying; the arms or legs may be more or less fixed or contorted, and become rigid in the position which they assumed by gravitation at the time of death. The lower jaw, if left to itself, drops and becomes rigid in this position. When a body is found rigid, with the members evenly extended, and the jaws closed, this is, *cæteris paribus*, strongly indicative of interference while there was warmth and pliancy in the limbs. When, on the other hand, the body is found rigid and doubled up, with the limbs more or less twisted lying on an even surface like a bed, the probability is, according to circumstances, that the body has been moved from the spot in which the person had died, and in which rigidity had supervened. In suicidal hanging, the body, and especially the extremities, are now and then found twisted in a singular manner around articles of furniture. In such cases, the general muscular convulsion, at the moment of death, will physiologically explain, what to uninformed persons may appear physically incompatible with the deceased having destroyed himself.

The following case will serve as an illustration of the occasional importance of these inquiries.

In June 1835, *Robert Reid* was tried before the High Court of Justiciary, at Edinburgh, for the murder of his wife. A report of this trial was published by Dr. Fletcher, who, although not a witness, lent his medico-legal assistance to the prisoner. Among the medical circumstances which gave rise to conflicting opinions was one which referred to the posture in which the body of the deceased was found, at half-past two o'clock, on Saturday, September 20, 1834, the day of the supposed murder. It was thus described by the witnesses. 'She (deceased) was sitting on the floor by the side of the bed, nearly naked, with a portion of the bed-clothes wrapt around the lower part of her body; the head erect, but inclined a little backwards and to one side, the face being towards the bed. The left arm hung down by her side, with the back of the hand on the ground, the right arm resting by the elbow on the bed, and maintained in the upright position without any further support, as if she had been in the act of putting it to her face. The legs were crossed under the trunk, the left being less protruded than the right.'

This extraordinary posture was presumed by all who saw it, and by the medical witnesses for the prosecution, to be such, that the deceased could not have assumed it herself in the act of dying; and this was rendered still less probable, when it was considered that the cervical vertebræ were fractured, and one of them was displaced, so that she had probably died a violent and very sudden death. The attitude appeared to be also quite irreconcilable with the supposition of death from accident or suicide. The chief question seems to have been, whether, admitting that the prisoner had actually placed his wife in this posture, the maintenance of it was to be ascribed to a convulsive spasm, simultaneously occurring with death, or to the supervention of ordinary cadaveric rigidity. If the posture were admitted to have been due to cadaveric rigidity naturally supervening, then the inference would be that deceased had been dead, at least, some hours. The prisoner was proved to have been at home from nine until half-past nine: the deceased's body was discovered at two, and as the prisoner had not been at the house between half-past nine and two, so it followed that, supposing him to have been guilty, he must have committed the murder during the half hour that he was at home. Hence, cadaveric rigidity must have come on in four hours and a half after death.

But, on the other hand, it was urged, that the attitude of the body, and the singular perpendicular position of the right arm, were due to a spasmodic contraction of the muscles in a fit, at the moment of death, persisting under the form of cadaveric spasm. The non-medical witnesses stated that the body of the deceased when found was perfectly flexible, and the arms and legs so pliant, that they could be easily stretched down; indeed, the whole body was so yielding as to admit of its being directly laid out at length on the floor. The body was partially warm when first found, but, as it has been already observed, this is quite compatible with the occurrence of rigidity. Certainly, however, where a body is warm and the members are easily moved from their position, the presumption is rather in favour of the fixed posture being due to muscular spasm than to cadaveric rigidity.

The witnesses for the prosecution considered that the posture of the deceased was owing to simple rigidity. Dr. Fletcher attempts to explain the facts by supposing that the deceased had probably fallen in a fit while getting out of bed, during the absence of the prisoner; admitting that the prisoner might on his entrance, at about nine o'clock, have attempted to raise the body, and thus have given the erect position to the trunk; while the perpendicular position of the arm was entirely due to spasm. It was urged that the woman had been previously subject to slight paralysis and convulsive fits, and that the occurrence of a fit, under the circumstances, was not unlikely. The position was not such as we might suppose a body to assume, when a person has died under a cataleptic seizure.

On the other side, it was considered to be improbable, that the prisoner could have placed the deceased in the attitude in which she was discovered, admitting her to have died in any other posture—since at the time he did it, the body must have been either rigid or not. If it were rigid, he could not easily have bent the members from the position which they had already assumed;—and if it were not rigid, he must have used artificial means to keep the members and trunk in the extraordinary position in which they were found: for it was not likely that he would have purposely held her head and arm in such a singular attitude, until her body had become fixed. Indeed, in order to accomplish this, he must have waited until it had become cold, whereas it is stated to have been found with some warmth and pliancy about it. Besides, it would be impossible to assign any reason for his so doing, since he would be ignorant of the medical difficulty connected with it.

The prisoner was discharged on a verdict of not proven, because it was not satisfactorily made out that he had really caused his wife's death. The state in which the body was found, created a presumption that the deceased had died, from natural causes, not long before the discovery of her body;—therefore, at some time between half-past nine and two, and while the prisoner was absent from the house.

The account of this case, as given by Dr. Fletcher, is of course made out in the most favourable way for the prisoner. Having been employed as medical counsel on the occasion, he suggested many ingenious explanations for circumstances which were certainly very strong against the prisoner. The verdict of 'not proven' sufficiently attests the opinion of the jury; and had the medical evidence respecting the cause of death from violence, been a little more clearly made out, there is hardly a doubt that the prisoner would have been convicted.

Whether this was a case of death from natural causes, or, as alleged, from an injury to the spinal marrow, we must regard the attitude in which the body was discovered as very unusual. There were difficulties in the way of an explanation, whether we suppose the prisoner to have interfered or not with the position of his wife's body. Had a proper examination been made by medical men when it was first discovered by the neighbours, some of these difficulties would not probably have existed. With a fracture of the dentiform process, and a dislocation of the first and second vertebræ, it is not likely, unless the body had been supported mechanically by the clothes which it is said presented the appearance of having been dragged off the bed with it, that a person so injured would die in the attitude in which the deceased was discovered, or that she could have had the power to assume it spontaneously after such a severe injury to the spinal column. The probability is, that the body would have been found lying on the floor.

A question was raised upon this trial respecting the duration of muscular spasm after death: and this may become at some future time, a point upon which a medical witness may be required to express an opinion. There is but little doubt, from numerous collateral facts, that it may remain for a considerable time after death; and even pass into cadaveric rigidity, *i. e.* the posture assumed by a limb from spasm, at the moment of death, may be retained as the posture of cadaveric rigidity, supposing the body not to have been disturbed. An instance is reported, in which a drowned subject, after having remained in water from twelve to fourteen hours, was drawn up with his hands still grasping firmly the cable of a vessel, which he had caught hold of in the act of drowning. The bodies of persons drowned in a common accident, are found not unfrequently after twenty-four hours firmly locked together by their arms, when taken out of water cold and rigid. In persons who die under violent spasmodic contraction of the muscles, as in cholera and tetanus, whether from natural causes or the effects of strychnia, the state of spasm is sometimes so preserved after death, as to pass into rigidity.

The attitude in which a dead body is found rigid, may easily give rise to an erroneous suspicion of murder. The following case has been reported by M. Marc:—The deceased, *Courbon*, was found dead in a ditch; his head was bent upon his chest, and the lower part of the trunk was so curved, that the whole weight was borne by the neck. The body was very rigid, but there were some slight traces of warmth when it was found. On inspection there were all the appearances of apoplexy, and the deceased was well known to have been of drunken habits. Notwithstanding these facts, two persons were convicted of murder upon some loose evidence,—principally on the ground that the unnatural position in which the deceased's body was found could only be explained on the supposition of murderous interference. The accused were condemned to the gallies for life; but after two years' punishment, a proper medical investigation of the facts was for the first time instituted, and they were discharged.

The evidence established that the deceased had died of apoplexy; and that the body had assumed the peculiar position in which it was discovered owing to the deceased having fallen into the ditch in a state of drunkenness, by which he was rendered helpless and incapable of extricating himself. ('Ann. d'Hyg.' 1832, 1, 569.)

While, then, rigidity may sometimes indicate murder, or some form of violent death, by fixing the body in a position which it could not naturally have assumed, and which cannot be easily altered during the rigid state, we must beware that we do not give an undue importance to this sign of death as a proof of violent usage. This caution is especially required in the cases of drunkards, for the body of a person who dies in a fit of drunkenness may be found contorted and disposed in a way which is apparently compatible neither with accident nor with suicide.

4. MUSCULAR IRRITABILITY.—In order to determine the reality of death, it has been proposed to test the irritability of the muscles by the application of an electric current. If a voluntary muscle laid bare for this purpose, does not contract under the application of this stimulus, the inference is that the person is dead; but if it should contract under these circumstances, it furnishes no proof that the person is living, in the ordinary meaning of the word. It has been elsewhere stated that the heart and involuntary muscles, which are readily affected by a mechanical stimulus soon after death, lose their irritability or power of contraction, even under a galvanic current, much sooner than the voluntary muscles. As a result either of disease or exhaustion, of the action of certain poisons, or of the effect of lightning, the irritability of the whole muscular system may be entirely destroyed at the time of death; in these cases no stimulus would excite muscular contraction. Under these circumstances rigidity and putrefaction so rapidly follow, that the application of electricity for additional evidence would be superfluous. On the other hand, in certain cases, as in the body of a decapitated man, whose case is recorded by Nysten, the irritability of the muscles may remain for twenty-six hours after death. In short it is now known, that until cadaveric rigidity commences in the body, muscular irritability is retained. When this commences it begins to disappear. Contractility of the muscles under the current would, therefore, prove either that the person was living, or that the body was in the first stage of death. All the muscles do not retain this irritability under the electric stimulus for the same length of time, nor do they all lose at once their susceptibility of contraction. One degree of stimulus may excite them, while another may not.

Dr. Dowler, of New Orleans, has shown by numerous experiments on the recently dead body, that post-mortem contractility may be excited by slight blows on the muscles given with the hand or any weapon, and thus electricity may be dispensed with. When the arm of a recently dead person was extended at a right angle with the trunk, a blow over the biceps muscle, not sufficient to injure a living person, caused the forearm to bend, carrying the hand to the chest repeatedly. In fact, before rigidity set in, the arm of this corpse, by the mere effect of slight blows, performed supination, pronation, and flexion most perfectly. This effect of slight mechanical violence is most distinctly observed within *half an hour*, but Dr. Dowler has seen it manifested as late as six or seven hours, after death. It disappears when rigidity sets in. ('Experimental Researches on Post-mortem Contractility,' by Bennet Dowler, New York, 1846, p. 601.)

It is a curious fact that the blood has no appreciable influence upon the post-mortem contractility of the muscles, because when the limb was severed from the trunk, and drained of its blood, its action was not thereby diminished;

('Am. J. Med. Sc.,' Oct. 1846, p. 440.) Contractions as the result of slight blows were observed in forty-three cases. The contractions were in many cases so forcible, as to cause a heavy weight to be lifted by the limb in which they occurred. The integrity of the corpse was not necessary; they were excited some hours after the dissection of the body, and after the limbs were severed from the trunk. Dr. Dowler considers that these muscular contractions have occurred spontaneously after the death of the body. Spontaneous movements in a corpse have been seen after death from cholera (case by Mr. Rumsey, p. 11), and the same may take place after death from yellow fever and other diseases. Dr. Dowler suggests that the changes in the position of the limbs of bodies sometimes observed after death, which have given rise to tales of premature interment, may be explained by the occurrence of spontaneous post-mortem contractions, depending on the long retention of muscular irritability in a high degree. Haller endeavoured to lay down the order of cessation of this irritability in different muscles after death. Many physiologists since his time have also occupied themselves with this question. Haller found that it varied according to the kind of stimulus employed: thus the irritability of the heart was excited by *mechanical* agents for a longer period than any other part of the muscular system;—a circumstance which was supposed to account for the reports of persons having been dissected alive, to be found recorded in some works on Medical Jurisprudence, an accidental puncture by the knife or forceps having given rise to contractions of this organ. But to admit this explanation, we must suppose that the body was inspected within one or two hours after death.

Nysten concluded from his observations that the successive disappearance of muscular irritability in the bodies of decapitated persons took place in the following order:—1. The left ventricle of the heart. 2. The stomach and intestines. 3. The urinary bladder. 4. The right ventricle. 5. The œsophagus. 6. The iris; and 7. The voluntary muscles of the body.

The power of making the muscles contract under the electric current, has been found to vary according to the nature of the disease of which the individual died. When it was such as to exhaust the strength, the time was very short. From experiments performed at La Charité, it appeared that in death from peritonitis, irritability ceased in about three hours; in phthisis, scirrhus, and cancer, in from three to six hours; in death from profuse hæmorrhage, or from mortal lesions of the heart, in about nine hours; in apoplexy with paralysis, in twelve hours; and in low fevers and pneumonia, the irritability disappeared in from ten to fifteen hours. In these experiments, the muscles of the trunk and limbs alone were examined; since it is upon these, should the necessity ever occur, that a practitioner must operate. Although the periods are thus laid down in figures, yet the results must be regarded only in the light of approximations to the truth.

We have now to apply these different data, connected with death and the changes of the dead body, to the solution of some medico-legal questions—such as the reality of death and the period at which death has taken place.

THE REALITY OF DEATH.—This question, of course, can only be raised in the period preceding the occurrence of putrefaction; therefore our observations on this point may be restricted within a very narrow compass. The question, indeed, might be passed over altogether, as unimportant, were it not that many men ranking high in the profession, have devoted much attention to the subject; and have thought themselves justified, from their observations, in declaring that premature interment was not unfrequently the means of consigning living individuals to the tomb. There is something terrible in admitting the bare possibility of such an event; and, therefore, we ought not to reject the supposition, without examining the numerous cases which have been brought forward in support of it. In the work of M. Fontenelle, published some years since, *forty-six* cases are recorded, either of the premature interment of the living, or of apparent being mistaken for real death. From a careful examination of all these cases, it appears to me that the greater number of them are derived from such sources, as to render them perfectly inadmissible as evidence of what M. Fontenelle so strenuously endeavours to prove. He has collected these cases from every source, whether scientific or not, from the time of Plutarch downwards. This very circumstance would make reasonable men distrust those instances of supposed death which are undoubtedly authentic, did not the facts appear explicable on the most common physiological principles.

The fears which works like that of M. Fontenelle are likely to excite, respecting premature interment, have been kept up by other French writers. M. Carré maintained that there was *no certain sign* of death but putrefaction; and that no body should undergo interment until this process had become plainly manifested. According to this gentleman, a *presumption* of death may be deduced from a great number of signs; a *probability*, from the combination of some of the most important, such as the collapse of the eyes, and especially cadaveric rigidity; but *absolute certainty* could only be obtained by the occurrence of the putrefactive process. Like other terrorists, M. Carré attacked each sign of death individually, but he wholly concealed the fact, that a judgment in proper hands was always formed from the combination of many signs or conditions; and that medical men are not responsible for the results, when, the decision of an important question of this kind, is entrusted to ignorant and uneducated persons. A petition was, on one occasion, presented to the French Chamber of Deputies, in which the petitioner declared that he had known six interments of living persons to have taken place within a period of eight months! Resting on similar authority, M. Carré asserts that since 1833, there have been forty-six cases of premature burial. Among these, twenty-one persons returned to life at the time they were about to be deposited in the earth: nine recovered owing to the affectionate attentions of their relatives: four from the accidental falling of the coffins: two from a feeling of suffocation in their coffins: three from the punctures of pins in fastening the shrouds: and seven from unusual delay in the funerals: and, it is added, after this marvellous recital, that the decease of all these individuals was officially attested! A statistical calculation is then made by him from the deaths which occur annually in Paris, of the average number of persons who were likely to be buried alive.

Statements of this kind can only be received with incredulity, since no particulars by which their accuracy can be tested are given. The cases of alleged premature interment that have yet been adduced, will not bear a close examination, as they are nothing more than the idle tales of ignorant and superstitious persons with the usual amount of exaggeration. In this country we have no official attestation of death by specially appointed persons; but if the account given by M. Carré be true, we have no reason to regret the absence of this system; since it is doubtful whether, under the practice of the ancient searchers of London in the worst days of the Plague, when bodies were indiscriminately thrown into large pits soon after death, greater negligence could have been shown than that which is here alleged to have occurred on the part of the French officials in modern times.

Cases have undoubtedly presented themselves in which persons labouring under concussion, syncope, catalepsy, hysteria, or lifelessness from exhaustion, have been pronounced dead by ignorant and uninformed bystanders, merely because there happened to be inanimation, coldness of the surface, and no outward signs of respiration or circulation. If the decision of the question of life or death was always left to such persons, and interments were to follow in a few hours upon their dictation, there is no doubt that living persons would be exposed to the risk of premature burial. But this can scarcely happen in any civilized country of Europe, and certainly not in England. In France the law ordains that every death must be verified by a medical officer; and no interment shall take place until after the lapse of twenty-four hours from the time of death. This rule, it is said, applies only to Paris and some of the chief cities of France. No inspection of a body is allowed to take place, and no interment to be made until after a certificate of death has been issued by the proper officer. A similar law prevails in Naples and in Portugal: but Fontenelle states that in the latter country, as well as in Spain, bodies are sometimes interred within *five* or *six* hours after death. In the Protestant parts of Germany and Switzerland, the dead are rarely buried until after the lapse of three days, a period being fixed by law, before which interment cannot take place. In this country there are no legal provisions relative to the period of interment; but, except under severe and continuous epidemics, the dead are rarely buried until after the lapse of from one to five days. It would, no doubt, be a good regulation if every dead body were seen and examined by a medical man twenty-four hours after death, and the fact of death were officially attested by him according to circumstances. The defect of the continental system is, that a medical opinion may be given at any time after the supposed decease, and there may be occasionally great negligence in the performance of this duty. Still it is impossible to admit that, except under the most culpable neglect, persons can incur the risk of being buried alive, when the body has been kept at least twenty-four hours from the period of the supposed decease.

It is stated on good authority that in a period of fifty years, during which mortuary houses have been established in various cities of Germany, no body deposited therein has ever been restored to life, when death had been already certified by a medical man. Such establishments are therefore not required if ordinary care is employed in making an examination ('Ann. d'Hyg.' 1848, 1, 107).

Non-professional persons may readily mistake a state of insensibility for death, and in acting upon this belief, may lead to the death of a living person. Mr. Guthrie mentions the case of a man labouring under concussion, while on board a vessel. He was supposed by his brother and the captain to be dead or dying, and without being able to make any movement to indicate that he was alive and understood their conversation, he heard them discussing the question whether his body should be buried at sea or carried on to Rotterdam. Fortunately the latter alternative was adopted.

Mr. Druitt reports two cases of a somewhat similar kind. A gentleman who was most severely affected with cholera in India, told him that when the disease had gained the complete mastery over him, he lay utterly deprived of speech and motion, whilst he could distinctly hear his attendants, who conceived him to be insensible, speculate on the time of his decease, which they judged to be very near at hand. He then, besides being speechless, became blind and deaf; but although thus cut off from all communication with the external world, and in common language insensible, he still retained his consciousness and self-possession, and reflected on his apparently inevitable death. Afterwards he lost all thought and consciousness, and remained thus on the very threshold of death for some hours; his recovery being an instance of the capriciousness of this terrible disease, which so often sets all medical calculations at defiance, causing the living to appear as if dead, and sometimes imparting to the dead, the heat and spontaneous movements of the living body.

The other case was that of a boy, æt. 6, the son of a milliner in Regent Street. He had the small-pox, was pronounced dead, and his body was put into a coffin. After some hours, he became conscious, heard the voice of his mother, who sat by the coffin, and he essayed to speak; but, as he afterwards said, he was unable to make any movement or sound. At last, however, his mother's attention was drawn to some apparent change in the features: she watched him narrowly, perceived the lips to quiver, and soon he was able faintly to articulate a wish for wine ('Ed. Monthly Journal,' April 1844, p. 355). These two cases have led the reporter to believe in the possibility of the hasty interment of the living as dead, while the unfortunate person is conscious of his condition, but unable to communicate his feelings to others. Mistakes of this kind are not likely to be made by medical men. In order to avoid the possibility of such occurrences, no interment should be allowed to take place until after the lapse of twenty-four hours, at the least, from the time of the supposed death; and not even then, except upon the certificate of a medical practitioner who has examined the body.

At present the *cause* of death is certified, and a body cannot be buried except upon the certificate of the registrar; but the medical attendant has it in his power to give this certificate without seeing or examining the body of the deceased at that period after death which is necessary for the clear development of the signs of dissolution. Hence, unless, as it commonly happens, the interment be delayed by the relatives for twenty-four hours at the least, there might be a risk of prematurely consigning a living person to the grave.

During the prevalence of epidemic disease, as in the time of the cholera, a provision was made, that interments should not be delayed beyond twenty-four hours, when death had taken place from the disease. There is no doubt that many bodies were interred during the raging of the epidemic within eight or ten hours after apparent death. One instance was communicated to me where the body was wrapped in a pitch cloth and buried within *six hours* after the signs of life had ceased. This was assuredly a most condemnable practice, especially in cases where the deceased had not been attended by a medical practitioner. Under no circumstances should a body be buried within a shorter period than twenty-four hours, when death has taken place from chronic disease, or without any obvious and satisfactory cause. No possible mischief can result to the living by the adoption of such a practice; while it would effectually guard against premature interment among the lower classes of society. In assigning twenty-four hours, this is to be taken as an average period; there are cases in which the most striking phenomena of death, such as coldness and rigidity, may manifest themselves within a much shorter time than this, and in such cases a medical opinion may be given without any difficulty. No coroner's inquest should be held upon a body until twenty-four hours after death. I have heard, however, of one instance in which an inquest was held on a body half an hour only after the apparent cessation of life.

If we allow a proper interval to elapse after the supposed death, there can be no difficulty in solving the question, whether a person is really dead even before any of those changes, which arise from putrefaction, have manifested themselves. The circumstances on which we may rely as furnishing conclusive evidence of death, are the following:—1. The absence of circulation and respiration for at least *an hour*, the stethoscope being employed if necessary; 2. The gradual cooling of the body, the trunk remaining warm while the members are cold; and 3. As the body cools, the gradual supervention of a rigid state of the muscles, successively attacking the limbs and trunk, and ultimately spreading through the whole muscular system.

When these conditions are observed, the proof of death is conclusive; it is unnecessary to wait for any sign of putrefaction. These changes are as certainly the forerunners of putrefaction as the process of putrefaction is itself the forerunner of the entire destruction of the body. I believe it may be safely said that there has not been a single instance of resuscitation after rigidity had once commenced in a body. During the raging of epidemics, if additional evidence be required for early burial, it might be obtained by exposing a superficial muscle to the galvanic stimulus. If the fibres do not contract, death is certain. If they do, this is no proof that the person can be restored to active life; but further time may be allowed before the body is committed to the grave.

So much alarm exists in some continental states relative to premature interments, that there are attached to the cemeteries of some great cities apartments, kept at a high temperature, where the bodies of the recently dead are deposited, and closely watched until putrefaction commences. Assistants are at hand with necessary apparatus for reviving those who may show any indication of returning life. Such institutions must be regarded as superfluous when ordinary care is taken by the relatives of a deceased person. I have not met with any instance in which a body laid out in them, was resuscitated after there had been a proper verification of death (p. 33). In the following case death was only apparent, but the fact created no difficulty. In December 1830, M. Ancelon was called to see a woman, æt. 34, and was informed on his arrival that she had been dead for more than half an hour. On examination, no signs of respiration could be detected, the pulse could not be felt, the skin was livid, the belly soft and flaccid, and the arms and legs were cold. It appeared that the woman had suffered from uterine hæmorrhage up to the time of her supposed death. He removed the contents of the uterus, and at this time a bubble of air was observed to escape from the mouth of the woman. On clearing the uterus, signs of life were gradually manifested by the woman. The respiration, indicated at first by air-bubbles, which succeeded one another on the lips, slowly returned; the circulation was also reestablished. She did not recover her intelligence for three days ('Monthly Jour. Med. Sci.' Oct. 1854, and 'American Jour. Med. Sci.' Jan. 1855, p. 268). This woman was not dead, but in a prolonged syncope from excessive hæmorrhage. Auscultation was not resorted to, or the sounds of the heart might probably have been heard, although the pulse could not be felt.

In a few remarkable cases of an authentic character, the process of putrefaction has been considerably retarded, and coldness and rigidity have not manifested themselves in the ordinary course. Such cases of apparent death would necessarily give rise to doubt; the phenomena observed were probably owing to the presence of some traces of molecular life persisting in the body after active life had entirely ceased. One of the most singular of these cases was reported some years since in Hufeland's 'Journal of Practical Medicine.' A young man, who was a patient in the hospital of Paderborn in Prussia, died, as it was supposed, under symptoms of phthisis, but not of a well-marked character. He had recently recovered from an attack of ague. The cause of death appears to have been obscure, and after, as it was believed, he had expired, his eyes were suddenly opened, and the physicians thought they detected for some minutes an irregular beating of the pulse. Some wounds and cauterizations were made on the body without arousing him, and on the third and fourth days these, it is said, had passed into a state of suppuration. On the fifth day his right hand turned back and closed; from the fifth to the ninth day a clammy perspiration was perceived upon the skin, and some vesicles containing serum were formed on the skin of the back. During this time there was no appearance of respiration or circulation, and the limbs, although cold, were pliant and flexible. The forehead was furrowed with vertical wrinkles, and the countenance had an expression not usually observed in a dead body. On the eighteenth day the lips presented their usual red colour, and, although the body was lying during this time in a warm room, there was no disagreeable odour and no cadaveric ecchymosis. On the twentieth day, the signs of putrefaction first became apparent, leaving then no doubt of the reality of death. As a report of this case was published in a medical journal of repute, although the details are imperfectly given, it may be considered authentic. As such, the conclusion to which it leads has already been anticipated. The ordinary signs of death, *i.e.*, slow cooling and progressive rigidity, were not observed. Further, when the body was exposed to conditions favourable to putrefaction, the changes indicative of this process are stated not to have been manifested for a period of twenty days. Such a case was altogether exceptional, and was thus treated by the hospital officials. The body was neither inspected nor buried, but simply watched until death was made certain by the actual occurrence of putrefaction. Had this patient fallen into the hands of ignorant nurses or attendants instead of professional men, it is probable that the body might have been consigned to the grave in two or three days. Although, as the event subsequently proved, this would not have furnished another instance of the premature interment of a living person, yet the proper course in all doubtful cases is to wait until that doubt has been satisfactorily resolved by the appearance of the obvious signs of decomposition.

A case of a somewhat similar nature occurred at Deptford in 1844. A youth died suddenly, and, in consequence of the body showing no signs of decomposition after several days, it was believed by the friends that the deceased was in a trance. The body was seen by several medical men, and they, in spite of some unusual phenomena, came to the conclusion that the youth was really dead. Some days after death the features acquired a natural character, and there was no change indicative of commencing putrefaction. The body retained its general appearance for twenty-eight days; but several medical men who saw it at this period, agreed that decomposition had begun. It was not until thirty-five days after death that the friends would allow an inspection to be made, and it was then found that deceased had died from an attack of congestive apoplexy. It was observed at the inspection that, in spite of the long period which had elapsed since death, and the exposure of the body to a warm temperature, putrefaction had made but little progress. In October 1849, a youth died at Bristol from an attack of malignant cholera in about fourteen hours. After the lapse of forty-eight hours, it is stated that the warmth of the body (post-mortem caloricity) was perceptibly retained, and there was no appearance of decomposition. Some days afterwards, however, the process manifested itself as usual.

Death-trance.—The slow access of putrefaction in certain cases is no doubt the basis of the Wallachian superstition, described by the late Dr. H. Mayo under the name of Vampyrism. When bodies were disinterred and had apparently undergone but little change, it was believed that they were transformed into vampyres, and that they had been nourished and preserved by sucking the blood of the living! As a mere effect of panic, the prevalence of this popular belief led to numerous deaths: those who died were hastily buried: the bodies of suspected persons were disinterred, and if found undecomposed they were either staked or burnt. The late Dr. H. Mayo in his 'Letters on the Truths contained in popular Superstitions,' has shown the absurdity of this superstition, but at the same time, he has suggested an explanation of the facts, which can only have the effect of creating alarm in reference to the premature interment of the living. He concludes, 'That the bodies which were found in the so-called vampyre state, were simply alive in the common way, or had been so for some time subsequently to interment; that, in short, they were the bodies of persons who had been buried alive, and whose life, where it yet lingered, was finally extinguished through the ignorance and barbarity of those who disinterred them.' But for the writer's high rank as a physiologist, such a statement as this would scarcely require notice. He is here referring to the bodies of persons exhumed after having been buried for periods varying from *six* to *twelve weeks*. The hypothesis that these persons had been alive for some time subsequently to their interment, would render it necessary to suppose that this vitality had continued to within a few days of their exhumation, otherwise it would be equally difficult to account for the absence of signs of putrefaction. Death-trance, however, according to Dr. H. Mayo, is a positive status; a period of repose, the duration of which is sometimes definite and predetermined, although unknown. Thus, the term of the death-trance having expired, the patient sometimes suddenly awakes, and is at once restored. 'The basis of death-trance is suspension of the action of the heart, of breathing, and of voluntary motion: generally likewise of feeling and intelligence; and the vegetative changes in the body are suspended. With these phenomena, is joined loss of external warmth, so that the usual evidence of life is gone' (p. 34). It is obvious from this statement, that the writer makes no distinction between life and death. All the ordinary phenomena of life may have ceased, and yet, if from any circumstances the decomposition of the body has been retarded, it may be contended that this person is not dead but simply in a death-trance. Such a startling and incredible hypothesis, is wholly unnecessary to explain the facts. If, as in the cases of retarded putrefaction elsewhere related (page 35), the bodies are buried within twenty-four hours after death, they will probably remain unchanged in the coffins in a deep grave for a very long period. By the act of interment the bodies are removed from the air, and are maintained at a cool and uniform temperature in the earth. In interments which take place during the winter-season, the bodies, *cæteris paribus*, are only slowly changed by putrefaction. This would constitute the vampyre state, or the death-trance as it has been accepted by Dr. H. Mayo: but it is simply regarded as death by all physiologists. The entire absence of the ordinary signs of active life is sufficient, according to this physiologist, to prove the absence of life,—a proposition which may be granted in reference to a *few hours* of time; but it would be unreasonable to adopt his method of inquiry, and judge of death by the presence of *one* sign only, instead of taking these signs in their totality and ordinary sequence. Premature interment is a condition which need not be dreaded in this country, where due precautions are taken even with the corpse of an unclaimed pauper; and it is to be regretted that otherwise well-informed professional men should strive to keep alive a groundless fear in the public mind, by their want of attention to the exceptional conditions to which experience shows the process of putrefaction is liable. ('Med. Gazette,' vol. 45, p. 21).

It may be occasionally difficult to form an opinion of the reality of death in cases of recent drowning or hanging. Coldness and stiffness of the body in the drowned, should not prevent the application of means for the restoration of life. One or two hours may elapse before signs of animation appear, and in one instance a drowned person was restored only after eight hours and a half spent in applying the means of resuscitation. There is reason to believe that some persons removed from water in a state of apparent death are consigned to actual death, owing to want of timely application of the means, and a want of perseverance in the treatment. The continued coldness of the body, and the absence of any evidences of success after a few trials, are commonly taken as sure signs that the person is really dead. There appears, however, to be, in some cases, a lingering vitality about the body. In an attempt to resuscitate a drowned person who had been five minutes below the water, and was speedily treated after removal, it was observed that the face which had been pale became suddenly livid, and underwent a remarkable change of expression. This appearance, however, was only momentary: continued efforts failed to restore life. In this form of asphyxia, as well as in hanging and suffocation, some caution is required in pronouncing that a person is really dead, since it at once discourages the efforts of those who are employing means for resuscitation. If the body has been for half an hour or longer under water,—if it has been found hanging or in a suffocating medium and is cold and rigid,—there can be no hope of resuscitation.

In new-born children it is sometimes difficult to say whether life has or has not ceased. M. Brachet has succeeded in restoring children, in whom the heart's action had been suspended from fifteen to twenty minutes. Respiration and circulation are carried on in such a tranquil manner in an apparently lifeless body, that except by the presence of some degree of warmth, and the absence of rigidity, the child might be pronounced dead. We have elsewhere recorded cases, in which children have survived birth for six, and even for twenty-four hours in this state of passive life. After death no air was found in the lungs. (See INFANTICIDE.)

CHAPTER 3.

INFERENCE OF THE TIME OF DEATH FROM THE STATE OF THE BODY BEFORE PUTREFACTION — PRIORITY OF DEATH — PRESUMPTIONS OF SUICIDE OR MURDER — OF SURVIVORSHIP — STAGES OF CHANGE AFTER DEATH — CADAVERIC LIVIDITY — SUGILLATION — ECCHYMOSIS.

THE changes which take place in a dead body before the commencement of putrefaction, if accurately observed, may sometimes enable a medical witness to form an opinion of the time at which the deceased died. The dead body of a person may be found in a house with marks of murderous violence upon it; the crime may have been so recently perpetrated, that the body still retains the warmth and pliancy observed in the recently dead, or it may be found in a cold and rigid state. A person charged with the murder may be able to prove that he had not been in the house for many hours, or days; or evidence may be adduced to show that he was there at a time which would correspond to the condition of the body when found. In cases of sudden death from violence or suspected poisoning, a medical man, by observing the state of the body, may frequently form a judgment of the time at which death occurred, and, therefore, of the period at which poison was taken by deceased, or violence was inflicted on the body.

In the following case of murder and suicide, the murderer was clearly pointed out by the difference in the condition of the two dead bodies when they were first discovered. In March 1836, a man and his wife were found dead in bed, and their bodies were covered with blood, from wounds inflicted on both. In the case of the woman there was a deep incision in the throat, besides a wound under the chin, and another on the side of the head. The man's throat was also severely cut; the razor with which the wounds had been inflicted, was found on the bed, within a short distance of his right hand, as if, in the last act of life, he had endeavoured to throw the weapon from him, but had failed in the attempt. The body of the woman was cold and rigid, that of the man was warm. The nature and direction of the wounds, and the marks of violence on the woman's person, were such as to render it probable that she had not committed suicide; and the condition of her body showed that she had been dead many hours. On the other hand, the wound in the man's throat was such, that he could not have long survived its infliction; and as his body, when found, was warm and pliant, it was a reasonable inference that the wife had died first, and from wounds inflicted by her husband, as no other person had access to the house. If the body of the wife had been found warm, while that of the husband was cold and rigid, the inference of his having been her murderer (the wound in her throat being of a nature to produce instant or very speedy death) could not have been sustained. In forming a judgment of priority of death in such cases, the sufficiency of the wound to produce instant or rapid death must always be taken into consideration. A person may inflict on another a slight wound, which may prove fatal by hæmorrhage only after some hours, while he may afterwards inflict upon himself a wound which would instantly destroy life. In such a case, the body of a murderer would be found cold, while that of the victim, by reason of the death being more recent, would be warm. In the case of a female who was found dead in her apartment, with her throat cut, in November 1847, it was ascertained that, when first discovered, the body was so warm as to render it highly probable that the crime must have been committed within an hour. This observation tended to prove the innocence of a party who was suspected of the murder, because it was known that he had been absent from the house for at least five hours.

In the following case, which is a type of many, the theory of suicide was sustained, and that of homicide completely rebutted, by a medical inference from the condition of the body. In August 1830, the Prince de Condé, or *Duke of Bourbon*, was found dead in his bedroom, in the Château of St. Leu. When discovered, at 8 o'clock in the morning, the deceased was found partly undressed, hanging by his cravat to one of the window shutters. The body was cold, and the lower extremities were quite rigid. As in asphyxia from hanging, the warmth of the body is usually preserved longer than under common circumstances, *i. e.*, from twelve to fifteen hours, before which period rigidity is seldom complete, the medical examiners inferred that the deceased must have died very soon after he had retired to his bedroom on the previous night. As this was proved to have been 10 o'clock, it followed that only ten hours had elapsed—a short time for cooling and rigidity to have taken place. It was thus rendered medically probable that the hanging took place soon after the deceased had entered his bedroom. It was alleged that the duke had been murdered, and his body afterwards suspended by his murderers to create the suspicion of suicide. The condition of the body, among other circumstances, was, however, adverse to this presumption. From 10 until 12 o'clock at night, it was proved that there were numerous attendants moving about near to the duke's apartments. These persons must have heard any unusual noise, which the duke would probably have made in resisting his assailants. But no noise was heard in the apartment at that or any other time, and the presumption of this being an act of homicide was therefore strongly rebutted. Had the body been found warm and pliant, and the joints flexible, the inference would have been that the deceased had died more recently, and therefore at a time when murder might have been perpetrated without attracting the observation of his attendants. As it was, the coldness and rigidity of the body justified the medical opinion expressed, and tended to prove that this was really an act of suicide.

Criminals sometimes unknowingly furnish important evidence in reference to the condition of the dead body. At the Lewes Autumn Assizes, 1860, a schoolmaster named *Hopley* was convicted of flogging a pupil to death. There was reason to believe that the boy had died during the actual beating. The accused stated before the coroner that he went into deceased's bedroom about six o'clock in the morning, and found deceased dead, his body cold, and his arms stiffening. He suggested that he might have died from natural causes. It was proved that the prisoner was heard in the act of beating deceased up to 11.30 on the previous night; and as the body was cold when found, and rigidity was commencing, there was a strong probability that deceased must have been dead at least six or seven hours, and, therefore, at a time when the prisoner was last known to have been with him. The body was well developed, covered with bedclothes, and the temperature not at the time low.

In the case of *Doidge* (Bodmin Aut. Ass. 1862), who was charged with the murder of a man, medical evidence derived from the state of the body when found, tended materially to corroborate the circumstantial evidence against the prisoner. The deceased was last seen alive at 10.30 P.M. on the night of the 7th June 1862. He was found the next morning, about 9.30 A.M., dead in his house; he was lying on his face with his clothes on—one arm under the chest, and the other by his side. He had received, on the back of the head, some severe blows, which must have proved speedily fatal. The body when found was quite cold, and the members were rigid. It was considered by Mr. Thompson, who saw the body, and by myself, that deceased, under these circumstances, had been dead from eight to ten hours. There was no doubt that this was an act of murder, and that the deceased had been killed while taking off his boots to go to bed. The prisoner was connected with the act by a chain of circumstances. He was seen drinking and conversing on friendly terms with deceased at a beer-shop the evening before. Prisoner left the shop at a quarter past ten, and deceased at half-past ten. They both lived near to the shop, and to each other. A neighbour of deceased's, who was out as late as twelve o'clock, heard at that time the voices of two persons in conversation in deceased's kitchen. One of them, he recognized as that of the deceased, and the other as the voice of the prisoner, with which he was well acquainted. This witness heard the voices for some minutes, returned into his house, and went to bed. He was soon afterwards suddenly awakened by a noise like that of a heavy fall proceeding from deceased's kitchen, in which the dead body was afterwards found. His evidence was corroborated by that of his wife: hence it is clear that deceased was alive for some time after twelve o'clock that night. It was further proved that, contrary to his usual practice, the prisoner did not return home to his lodging until one o'clock in the morning; and then, in order to account for his return at so late an hour, he made a statement which was proved to be untrue. The coldness and rigidity of the body, therefore, when discovered at 9.30 A.M., considering the season of the year, and the circumstance that deceased was in his clothes, were facts in themselves quite consistent with the occurrence of death soon after twelve o'clock at night, or about the time when a heavy fall was heard by the neighbour. Other circumstances, which were proved, left no reasonable doubt of the prisoner's guilt, and he was convicted.

Perhaps no case has brought the importance of questions of this nature so prominently before the public as that of *Gardner*, a chimney-sweep, who was tried and convicted of the murder of his wife, at the Central Criminal Court, in October 1862.

The prisoner lived with his wife and another woman named Humbler. The wife was found dead in her bed-room, with wounds in her throat, at eight o'clock in the morning of the 15th September 1862. The nature and direction of the wounds, the position of the body, and of the weapon, as well as other circumstances, conclusively proved that this was an act of murder; and as there were no persons in the house at the time of the occurrence excepting the woman Humbler (the servant) and the prisoner Gardner, it followed that one or both must have been concerned in the act. Gardner accused the servant, Humbler, of having perpetrated the murder during his absence from home; but as there was no evidence against this woman, he alone was subsequently called upon to answer the charge. The facts, as they bear upon the question which we are now considering, are very simple. Mr. Sequeira saw the body of deceased, a healthy, well-developed woman, æt. 37, at eight o'clock in the morning. Her body was found lying on a wooden floor, covered with a flannel petticoat and a chemise. The upper limbs were cold and rigid; the face, shoulders, and chest were cold; the neck was so rigidly fixed with the trunk, that the entire body was lifted up with it, when the head and neck were raised; the thighs and legs were quite cold, but there was no rigidity in these parts. The only warmth found about the body was in the lower part of the abdomen; and this obviously arose from the contents of the uterus, the deceased being in the seventh month of pregnancy. The opinion given by Mr. Sequeira regarding the time of death before its exact bearing on the guilt of the prisoner could have been known, was that the deceased had been dead *above four hours*, certainly more than three, and that she could not have been dead so short a time as two or three hours when he first saw the body. This opinion was corroborated at the trial by another medical witness, Mr. Comley, this gentleman affirming that, considering the general coldness of the body, the deceased, when seen at eight o'clock, had been dead above, rather than under, four hours. There was a severe wound on the throat, involving the superior thyroideal artery and other vessels. From this, about two pints of blood had flowed on each side of the neck on the floor. The larynx had been laid open between the thyroid and cricoid cartilages. Blood had flowed into the windpipe through this aperture, and had thus, by obstructing respiration, produced death by asphyxia.

Without going into all those circumstances which tended to fix this crime beyond any reasonable doubt upon the man Gardner, it may be sufficient to state that the defence turned principally upon the condition of the dead body when found. It was proved that from four to eight o'clock in the morning, i. *e.* for about four hours, the prisoner was absent from home, following his usual occupation as a chimney-sweep. It was contended by his counsel, that within this short period the body might have become cold and rigid as it was found, and, therefore, that the murder had been perpetrated by some one during his absence. On this theory the woman Humbler alone was guilty. The facts proved at the trial were, however, considered by the jury to be quite inconsistent with the innocence of the prisoner, and he was convicted of the crime. The subsequent commutation of the sentence to penal servitude or life, is a proof that the authorities considered that he was the principal if not the sole perpetrator of this crime.

The opinions given by the medical witnesses at the trial, regarding the nference derivable from the state of the dead body, were reasonable, and in accordance with scientific observations. In assigning *four hours* for the almost ntire cooling and commencement of rigidity in the dead body of a woman uddenly dying in the prime of life, the body not being exposed to any pecially cooling influences, it is obvious that they could not be charged with verstating, but rather with understating, the period of time required. Condering that death had taken place by asphyxia, if they had assigned six or ght hours, it would have been only consistent with ordinary experience. is, indeed, more probable that this time had actually elapsed, and that the woman had died in from two to four hours before the male prisoner had left the house, than that her body, under the circumstances proved, had become cold and partially rigid in less than four hours. In the hundred cases observed by Dr. Wilks and myself, there was not an instance in which such rapid cooling and access of rigidity occurred. In Mrs. Gardner's case, it was supposed that the loss of blood would account for this state of the body at so early a period after death; but, in the first place, the deceased did not die from hæmorrhage, but suffocation; and, secondly, a well-marked case elsewhere related (page 7), shows that the loss of twice as much blood in hæmorrhage proving suddenly fatal, led to no acceleration of cooling or rigidity in the dead body. Irrelevant experiments on animals, and theoretical speculations of an *ex post facto* kind, advanced for a particular object after a conviction for murder, should not be allowed to weigh against opinions deliberately formed and expressed by professional eye-witnesses, who, by their evidence on oath, could have had no intention either to exculpate one person, or to inculpate another. As this was clearly a case of murder, and one of two persons must have perpetrated it, the more the charge was removed from the man, against whom there was strong circumstantial evidence, the more completely it was fixed upon the woman Humbler, against whom there was nothing but an extemporized medical speculation, that a body dead, as it was erroneously assumed, from loss of blood, might become cold and rigid in less than four hours! Had this medical speculation been adopted as true, and acted on *bonâ fide*, it would have exculpated the man, and have led to the conviction and execution of the woman. It will be easy to show that this speculation, which served its purpose, *pro hâc vice*, of mystifying the medical features of the case, is wholly opposed to the observations of physiologists, who have really studied the changes which take place in the dead body.

As cadaveric rigidity had commenced in the upper part of the body of the deceased when it was first discovered, we may take this as a point of comparison with the actual observations of Nysten and Brown-Séquard. According to Nysten, in cases in which death took place suddenly in healthy persons, either from asphyxia or as a result of hæmorrhage, cadaveric rigidity did not commonly appear until sixteen or eighteen hours after death, and sometimes lasted six or seven days. Brown-Séquard states, that in the bodies of healthy persons decapitated or asphyxiated, cadaveric rigidity did not appear sooner than ten or twelve hours after death ('Proc. Royal Society,' 1861, No. 44, p. 211). Considering these facts, and the circumstances under which this body was found, the assignment of a period of six or eight hours would have been quite within the limits of experience and observation. The medical opinions given at the trial were consistent with ordinary experience, and with the other facts proved in the case.

The case of *Jessie McPherson*, for the murder of whom a woman named McLachlan was tried at the Glasgow Autumn Circuit, 1862, furnishes an additional proof of the correctness of these views in reference to the bodies of persons found dead from loss of blood. Dr. G. Macleod saw the body of deceased on the night of July 7, when it was first discovered. The mean temperature of the air on that day had been 50°. 'The rigor mortis was present in all the articulations, but it was then departing. The body was perfectly cold, even on the abdomen, and at the flexures of the joints. On the following day, at 10 A.M., the rigidity had gone from all the joints excepting the knees and ankles. There were no signs of decomposition, and the temperature was very cool, unusually so for the season. The room in which the body had lain was well ventilated, but without a draught. I was below the level of the street, and the body lay on a wooden floor, and was partially covered. Further, death had resulted from violence; it had been attended with profuse hæmorrhage, and the victim was free from disease in the prime of life (æt. 35), and of a thin, wiry frame.' Dr. Macleod, considering that the rigor mortis commonly appears in from ten hours to three days after death, and that in sudden death from violence it is only slowly developed, thought it most probable that forty-eight hours after death (at the longest) would represent the time when rigidity would appear. 'The more rapidly it is developed, the sooner it disappears, and vice versâ. The average period of disappearance is from twenty-four to thirty-six hours. In the case under review, resting on the same considerations as influenced the opinion formed of the time of the establishment of the stiffening, it was thought that about thirty hours would probably represent the period of the continuance of the rigidity; and by summing these periods—forty-eight and thirty—together, the conclusion was arrived at that about *three days* had probably intervened since death; and it will be remembered that it was afterwards proved that this was, as nearly as could be, the time which had passed between death and the examination of the body.'

'Putrefaction appears on an average under a mean temperature in from three to six days. It is influenced by many circumstances, of which the heat and moisture of the surrounding atmosphere, the obesity and age of the person, the cause of death, the position and coverings of the body, are the chief. In the case of McPherson there was no appearance of decomposition. The cool atmosphere, thin body drained of its blood, the middle age, and thin covering, all opposed its development' ('Account of the Medical Evidence at the Trial of Jessie McLachlan,' by G. H. Macleod, M.D. Glasgow, 1862, p. 8). This medical opinion formed from the state of the body, tended to confirm that part of the prisoner's story which related to the time of death.

On these occasions, unless we have a due regard to all the circumstances of a case, great errors may be committed. We may assign a period for death which is inconsistent with the proved facts, and thus give impunity to murderers. Ollivier and Devergie were once required to examine a medical report by two physicians, in which they stated that they had found the deceased, a woman, aged sixty, dead in her apartment from strangulation. When the body was found it was lying on the floor, clothed in her usual dress of cotton and flannel, in a state of cadaveric rigidity, with general lividity of the surface of the skin. It was cold, with the exception of a slight warmth which remained in the abdominal viscera when the inspection was made. ('Les viscères renfermés dans la cavité abdominale, ne nous paraissent pas dans un état de refroidissement complet.') From these data the inspectors came to the conclusion that deceased had not been dead more than from fifteen to twenty hours before the time at which they saw the body. This would have fixed the date of the murderous assault at one o'clock P.M. on March 6, whereas the general evidence tended to show that the crime must have been committed on the night of March 4 or 5.

Considering that the deceased had died from asphyxia, in which case warmth is usually retained, that her body was well clothed, and yet rigid and cold, with the exception of a doubtful trace of warmth in the abdominal viscera, Ollivier and Devergie came to the conclusion that she must have been dead for a longer period than fifteen or twenty hours; and, without defining the precise time, which, under the circumstances, was not necessary, they affirmed that there was no medical ground on which such a restriction of the period of death was justifiable. They contended that cadaveric rigidity, when once established, might remain two, three, or four days, according to the season of the year and other circumstances; and that when it existed, there was no rule by which it could be determined whether the body had been in this state for two or three hours or two or three days ('Annales d'Hyg.' 1833, 1, 212). The retention of warmth by the abdominal viscera may be met with after fifteen to twenty hours, in a much more marked degree than in this case. In one case, already referred to in the table (No. 26) published in 'Guy's Hospital Reports,' the temperature of the viscera of the abdomen, more than seventeen hours after death, was found to be 76°, although no care had been taken to preserve the warmth of the body.

These changes in the dead body, may occasionally have an important application in reference to civil suits. When two persons are found dead under similar circumstances, a presumption of survivorship might arise in favour of one, by reason of the condition of the body showing a more recent death. A husband and wife, the latter possessing property in her own right, may be found dead in the same apartment; the body of the husband may be cold and rigid, while that of the wife may be warm and pliant. It might in this case be presumed that the wife had survived the husband, and the heirs of the wife, if she died intestate, might claim her property. On the other hand, if the body of the wife was found in a state of decomposition, while that of the husband was either cooling or in a state of commencing rigidity, there could be no doubt, medically speaking, that the presumption of survivorship lay with the husband, although no human eye may have witnessed the death of either. In this case the few hours' survivorship might be held to transfer the property of the wife to the husband, or through him to the claimants on his part. In these contested cases of presumed survivorship, the litigation between contending parties is often carried to an extreme degree, so that every medical or scientific fact which can be made available, will be brought out on either side.

Some French medical jurists have attempted to give a more definite character to these changes in the recently dead body, by dividing the interval between the permanent cessation of the heart's action and the commencement of putrefaction into three stages or periods. In the first, the warmth and pliancy of the body and muscular irritability remain; in the second, these conditions are lost, and the body is cold and rigid; in the third, the body is cold and pliant, the muscles are relaxed, and the joints are flexible, cadaveric rigidity having entirely ceased. A fourth period is marked by the access of putrefaction, in the appearance of one or more well-known signs indicative of chemical decomposition. There can be no doubt about the existence of these stages, but when we attempt to define the precise time at which they commence and succeed each other, the subject is beset with great difficulty. Thus, according to Devergie, the first stage ranges over a time which cannot be more closely defined than by stating that the person may have been dead from a few minutes to twenty hours! From the differences observed in different bodies, there would be some danger in fixing these times too strictly; and a medical jurist must be prepared to find that in a question of murder, a counsel who defends a prisoner will reject averages, and take, for the purpose of defence, the longest or shortest period of time within which the respective changes have been known to occur. In spite of this objection to medical evidence, it may be convenient to consider the subject in reference to the three stages or periods proposed by Devergie.

First Period.—This is characterized by the heat of the body being more or less preserved, and by a general or partial relaxation of the voluntary muscles. In such a case as this, after attentively considering the various circumstances special to each, which may have retarded or accelerated the cooling of the body, an inference may be drawn that death has taken place from a *few minutes* to *twenty hours*. These are the extreme limits, and the time will vary according to the degree of heat in the trunk and extremities, and the degree of rigidity in the muscles, as well as the parts of the body affected, the neck and the jaw commonly showing this condition first, and the legs the last. It is rare that the heat of the body is preserved for so long a time as twenty hours;. in general it is sensibly cold within ten or twelve, but this estimate will be more or less affected by the condition of the person who makes the observation. During this period, the muscles are susceptible of contraction under the galvanic stimulus, and in the early stage under the mechanical stimulus of blows.

Second Period.—In this the body is perfectly cold throughout, and the cadaveric rigidity is well marked. The muscles are no longer susceptible of contracting under galvanic or mechanical stimuli. In such a case death may have occurred from *ten hours* to *three days.* It is impossible to give a more definite opinion than this, since there are conditions which may develope rigidity, and under which a body may become cold in ten hours or even a shorter period. In one instance already related, a body was found cold and rigid nine hours after death. Again, there are, as we have seen, other conditions which may prevent the cooling of the body, and delay the occurrence or prevent the disappearance of rigidity for so long a period as three or even four days after death. The duration of this stage from ten hours to three days includes the average cases. Here, again, in forming an opinion we are bound to regard the age, the mode of death, and the circumstances under which the body of the deceased may have been exposed.

Third Period.—The body is perfectly cold: the members and trunk are pliant, and are quite free from any remains of cadaveric rigidity. As this condition has ceased spontaneously, the muscles no longer contract under the influence of the galvanic stimulus. Under these circumstances it may be assumed that the person has been dead from *three to eight days.* In the summer season, however, this period is much shorter : it will more commonly be found to be the condition of bodies which have been dead from one to three days.

Fourth Period.—This commences with the access of putrefaction. It is first manifested by a slight blueish-green discoloration of the skin of the abdomen, and it gradually spreads throughout the body in the manner elsewhere described (page 53). Any doubt concerning the reality of death, must cease when the body has reached this stage, at whatever period of time it may manifest itself. Devergie considers this state to represent the condition of the body from *six to twelve days* after death, but the fact is well known that putrefaction may manifest itself on the first or second day, and sometimes as late as the twelfth day after death. These different periods are somewhat arbitrarily selected, and they can be looked upon only as affording approximative results. During the heat of summer a body may undergo in twenty-four hours all those changes which Devergie assigns to be a period of from six to twelve days, while in winter the same changes may not be complete in a shorter period than fifteen days. The power of giving a safe medical opinion, must therefore depend on an accurate observation of the state of the dead body when first seen, and a proper estimation of all the causes which influence or modify the successive changes. Notwithstanding the apparent want of precision which medical evidence necessarily presents in investigations relative to the period at which a person died, yet the cases already related, show that approximative results are often of great value. When founded on a correct knowledge of the state of the body, and when they are corroborated by other circumstances, they are received in law with the greatest benefit to the administration of justice.

Cadaveric Lividity and Ecchymosis.—There are certain external changes which take place in a dead body before the access of or during putrefaction, to which it is necessary that a medical jurist should attend. There is what is called *cadaveric lividity*, which comes on during the act of cooling. At a still more advanced period, dark livid spots or patches are met with in the skin, to which the name of *sugillation* or post-mortem ecchymosis has been given (see 'Henke Zeitschrift der S. A.' vol. 1, p. 199). These appearances have often been mistaken for the effects of violence applied during life, and serious mistakes have thence arisen. Innocent persons have been accused of murder or manslaughter, and have been tried on charges afterwards proved to be groundless. Dr. Christison refers to two cases, in one of which two persons were convicted, and in the other, three narrowly escaped conviction, upon a mistake of this kind.

A man named Keir and his mother were tried on the Aberdeen circuit, for the murder of his father. This case excited great interest at the time, and for many years afterwards. The prisoners were condemned, but the only evidence of any weight against them was the appearance of a broad blue mark on the fore part of the neck, which the witnesses compared to that produced by strangulation. There was, however, great reason to believe, from their own description of it, that it was due to natural changes taking place after death. The other case occurred in Edinburgh. Three men left a public house, intoxicated and quarrelling with each other. On the next morning one of them was found expiring in a wood, and he died soon after he was discovered. Two surgeons deposed, that they found the marks of numerous contusions all over the body; and upon this deposition, the two companions of the deceased were committed, and subsequently tried for the murder. On the trial, Messrs. Bell and Fyfe proved to the satisfaction of the Court, that the apparent contusions were nothing else than the livid patches, which sometimes occur spontaneously on the dead body, after many kinds of natural death. Of course, this led to the liberation of the accused parties.

These spontaneous changes in the dead body must, therefore, be attended to by the surgeon. They may be considered, by dividing them into those which take place *before putrefaction*, and those which take place *afterwards.*

The first form (before putrefaction) is dependent on a stagnation of blood in the capillary vessels. So long as there is life, the capillary circulation continues. This may be ascertained by puncturing the skin or lip with a fine needle; if the capillary circulation is going on, a drop of blood will escape, otherwise not. When after death the capillaries have lost their contractility, the blood appears to stagnate in them in an irregular manner, producing *lividity*. The skin of the body, although pale at the time of death, becomes covered during the act of cooling by extensive patches of a blueish or slate colour, diffusing themselves over the greater part of the trunk and limbs. The colour is sometimes of a deep purple, often mottled, but generally abruptly terminating in the white skin. This kind of ecchymosis is chiefly seen on the bodies of those who have died suddenly in full health, or by a violent death, as in apoplexy, hanging, drowning, suffocation from charcoal vapour, and other causes. In the latter case, it has been found in some instances to be especially developed. It is rarely seen in the bodies of those who have died from hæmorrhage; the skin is in these cases commonly pallid. When the skin in which the lividity is seated is divided, it is seen that the colour is confined to the upper layer of the true skin (cutis), or to the space between the cuticle and cutis, and never to extend through the latter. There is no sanguineous effusion, but apparently a simple congestion in the minute capillary vessels.

The unruffled state of the cuticle, the great apparent extent of the discoloration, the fact that it affects many parts of the trunk and members, and often entirely envelopes the whole circumference of one or both limbs, are, together with its abrupt termination, and the absence of extravasated blood in the cellular membrane beneath, circumstances sufficient to distinguish it from the ecchymosis produced by violence.

Sometimes this lividity is disposed in a peculiar form over the body. If a stout and muscular person has died suddenly, and the body, wrapped closely in a sheet, is allowed to cool, the lividity may be sometimes disposed in the form of a number of stripes or bands over the whole surface—the congestion of the vessels taking place in the interstices of the folds, while the parts actually compressed remain white. The appearance of the body is such that we can hardly divest our minds of the idea that the person must have been flogged. The unbroken state of the cuticle, with the other characters just now mentioned, are, however, sufficient to distinguish this appearance from the effects of violence. This kind of lividity is known under the name of *vibices*. It is often seen on the backs of subjects that have been allowed to cool either in their clothes or on any rough and uneven surfaces. A few years since I saw a well-marked case of vibices, in which the suspicion was so strong that violence had been used to the deceased, that a coroner's inquest took place. The fore part of the body was covered with stripes, which were of a red and livid colour: they appeared to correspond exactly to the folds of a sheet drawn tightly across the chest; and it was subsequently ascertained that the body of the deceased had been treated in this manner after death. The blood was superficially diffused, and the cuticle uninjured. The circumstance above mentioned at once satisfactorily explained the cause of the appearance. These vibices or weals, like the cadaveric lividity already described, are commonly seen in plethoric persons; they indicate great vigour of circulation at the moment of death. But lividity in the dead body occasionally presents itself under a more deceptive form than in either of the instances just mentioned. This is well shown in the case of a man who died in November 1837, on board of the Dreadnought hospital ship. The subject of this case, æt. 33, died suddenly from disease of the heart. Just before death the deceased had been auscultated, and no marks then existed on the skin. The body, after about eighteen hours, was examined, and then it was found to present, in detached places, patches of discoloration or ecchymosis, varying in size from small spots to several inches in diameter. Although closely simulating bruises or marks of violence during life, a slight examination showed that they were owing to simple lividity, because those parts of the back and limbs which were not compressed by the surface on which the body of the deceased was lying, were the only parts discoloured. The calves of the legs, the loins, and the back, which bore the pressure, were white. On cutting into these patches, the layers of the skin, as well as the tissues beneath, were throughout reddened by congested blood, and small rounded semi-coagulated masses oozed out from the cellular membrane on slight pressure.

These characters somewhat resembled those produced by violence on the living body; but there was another, and, I believe, an unexampled circumstance, in which the resemblance to *vital* ecchymosis, existed. Around many of the patches there was a wide border, or zone, of a pale straw colour, with various shades of green and blue, precisely similar to those which are seen in the gradual disappearance of an ecchymosis from the living body. By most medical jurists it has been hitherto considered that the zones of colour are peculiar to vital ecchymosis, and are never seen in the ecchymosis produced after death. The occurrence of this case shows with what caution general rules should be framed for medico-legal practice. Had the body of this person been found lying dead and exposed on a high road, and had it been proved that another man had been seen quarrelling with him, what might have been the opinion expressed? We can scarcely hesitate to say, unfavourable to the accused person.

This kind of ecchymosis could have been distinguished from that of violence during life only by the unruffled state of the skin, and the slight effusion of blood, compared with the extent of discoloured surface. It is worthy of note, also, that the chief seat of ecchymosis, was in those parts which were recumbent or depending. The formation of the coloured zones around some of the patches of lividity was fully explained by the fact of the man having laboured under general dropsy. The serum effused in the cells, here acted upon and diluted the liquid blood, as it exuded from the vessels and diffused it around, much in the same manner as the serous exhalation of the cellular membrane acts on the blood effused in the living body.

A question, connected with lividity, or cadaveric ecchymosis, was raised on the trial of *Reid* (p. 27), namely:—Whether this cadaveric lividity always *preceded* cadaveric rigidity or not? Rigidity is not in general strongly manifested until the body is cold; the lividity here described takes place while the body is cooling and the blood is liquid. The occurrence of rigidity depends on the time at which muscular irritability is entirely lost: but post-mortem discoloration of the skin is closely connected with the presence of warmth in the body, and with fluidity of the blood; hence cadaveric lividity begins to develope itself often soon after death, and continues to increase until the body is cold, when its formation is entirely arrested. It appears to consist simply in a congestion of the capillary vessels, and is produced before the coagulation of the blood in the first stage or period after death. As it has now been clearly proved that rigidity affects the heart and coats of the arteries before rigidity of the voluntary muscles manifests itself, it is highly probable that in the contraction of these tubes, the blood is forced at first through the capillaries into the venous system, and afterwards, from want of sufficient power of propulsion, it stagnates unequally in these vessels, producing livid patches on the skin: although the arteries are relaxed and become quite flaccid, the blood remains in the minute vessels in which it has collected.

Another form of ecchymosis observed in the dead body, is that which occurs some time after death. This appears to proceed from an infiltration of blood into the depending parts of the body, and to be a result of incipient putrefaction. They who are much engaged in inspections are well aware that the skin of the back, especially that covering the loins and buttocks, often presents irregular discolorations resembling ecchymosis. The skin of the back of the head and nape of the neck is a well-known seat of this form of ecchymosis. On cutting into the skin of any of these parts, it is found to be more or less discoloured throughout, and the fatty tissue is filled with a bloody serum, which readily escapes. In proportion as putrefaction advances, the discoloration becomes greater, passing from a dark red to a green colour. The general characters of this kind of ecchymosis are so well marked, that it cannot easily be confounded with the ecchymosis of violence. The parts of the body in which it is known to occur, as well as the state of the body, are circumstances which distinguish it from all the other forms described. This variety of ecchymosis is also termed sugillation by some medical jurists. (On the subject of Ecchymosis, see 'Ann. d'Hyg.' 1838, t. 2, p. 383.)

CHAPTER 4.

PUTREFACTION—ITS NATURE AND PROGRESS—PRODUCTION OF GASES—POST-MORTEM HÆMORRHAGE—PRESSURE ON THE VISCERA—NATURE OF THE GASES OF PUTREFACTION — CHANGES IN THE COLOUR OF THE SKIN AND OTHER ORGANS — PUTREFACTION IN AIR—CONDITIONS FOR THE PROCESS—CIRCUMSTANCES WHICH MODIFY IT—INFLUENCE OF DISEASE AND CERTAIN POISONS—PUTREFACTION IN BODIES BURIED IN GRAVES—PRODUCTION OF ADIPOCERE—ITS CHEMICAL NATURE.

Putrefaction.—By putrefaction, we are to understand those chemical changes which spontaneously take place in dead animal matter, during which offensive gases are evolved. The ultimate effect of these changes is, after a longer or shorter period, to reduce the organic to the condition of inorganic compounds consisting chiefly of water, ammonia, and carbonic acid. It is in the stage of transition that noxious effluvia are evolved from which the process derives its name. These consist of compounds of nitrogen, sulphur, phosphorus, and carbon with hydrogen.

This process does not begin to manifest itself in the dead body until after the cessation of cadaveric rigidity, and generally about the third day. It is then observed, if the body has been exposed to the atmosphere in an apartment of mean temperature (60°), that the limbs and trunk become supple and pliant, and yield a faint odour. The skin covering the abdomen becomes of a pale green colour, which gradually deepens. A similar discoloration slowly makes its appearance in the chest, between the ribs, in the face, the neck, the legs, and lastly, in the arms. The colour appears to depend on the decomposition and infiltration of the animal fluids, especially the blood, into the skin. In the neck and limbs it is observed to be more marked in the situation of the large venous trunks; and sometimes, indeed, the course of the superficial veins is accurately traced out by greenish-blue or dark lines; these have been mistaken for marks of violence. This change in the colour of the blood infiltrated into the tissues is probably owing to the action of ammonia as a result of decomposition, on the red colouring matter. In a more advanced state we have found the blood to contain sulphuretted hydrogen as well as ammonia in the form of sulphide of ammonium and carbonate of ammonia. Its colour is then dark brown, almost black, and it effervesces strongly when an acid is added to it. Gaseous products are formed, not only in the hollow organs of the abdomen, but beneath the skin generally; so that on making an incision, the edges of the skin are rapidly forced apart or everted. The reaction of this confined gas accounts for the occasional escape of alimentary and fæcal matter from the outlets:—as also for the escape of blood some days after death from wounds involving any of the large veins.

This *post-mortem hæmorrhage* requires one or two remarks. Its occurrence formerly gave rise to the most superstitious notions, and even in the present day, an undue importance may be attached to it by a coroner's jury. In order to explain this, and some other apparently vital phenomena connected with a dead body, it will be necessary to refer to those spontaneous changes which commence soon after death. When a person has died suddenly from violence or convulsive disease, it may happen that within a short period the whole of the cavities, including the veins, arteries, and cellular tissue beneath the skin, become distended with gases derived from putrefaction. The gases collected in the abdomen, push back the diaphragm, in consequence of which, mucus with air-bubbles issues from the mouth and nostrils; the face is swollen, and the eyes are bright and prominent, owing to the blood having been forced back to the head and neck, by the distended state of the abdomen and viscera. For a similar reason the contents of the stomach are sometimes discharged, escaping into the trachea, or flowing externally by the mouth and nostrils. That which, however, more immediately concerns us at the present time, is the development of these gases within the heart and large blood-vessels, in consequence of which blood may be forced out of a wound made before death, long after all the phenomena of life have entirely ceased. If an attempt has been made to bleed a person immediately before death, without success, and the operator has neglected to secure the opening in the vessel, it may happen that, some hours after death, a large quantity of blood will escape by the wound—conveying to those, who are uninformed on these matters, the idea that the person had again come to life, but had died from the bleeding. An accident of this kind gave rise to considerable discussion, on the occasion of an inquest held at Oldham, on the body of *John Lees*, killed in the Manchester riots, as also in the case of the Crown Prince of Sweden, who was suspected to have been poisoned. A similar flow of blood may take place from a large incised wound, made recently before death. This post-mortem hæmorrhage is facilitated by pressure, and on this was based that ancient test of guilt; viz. the touch of the murderer.

When there is no open wound from which blood can escape, the cavities of the heart may suffer compression from gases generated within the chest and abdomen, and a portion of the blood may be thus forced out of them. If full at the time of death, and the body is examined within a week, it is not probable that the cavities would be completely emptied. If the heart is found empty, and at the same time contracted, its emptiness cannot be assigned to the effects of putrefaction; it was most probably the natural condition of the organ at the time of death. A collapsed and empty condition of the lungs has been ascribed to pressure from the gases of putrefaction, the medical assumption being that they had contained air and blood at the time of death. This is not in accordance with my observation. In advanced putrefaction these organs have also contained gaseous matter and dark-coloured liquid blood. In examining putrefied bodies in cases in which death has been alleged to have been caused by some form of asphyxia, *i.e.* strangulation or suffocation, it will be important for the medical witness to bear in mind these conditions of the heart and lungs. They may be found empty and collapsed; in such a case, he must not be too ready to assume, in order to reconcile this condition with the foregone conclusion of a violent cause of death, that they were full of blood or congested at the time of death, and that their emptiness is owing to post-mortem changes. It may be equally probable that they were empty when the person died, for emptiness of the heart and a collapsed state of the lungs, are frequently found in bodies which are not putrefied: hence the medical opinion in a given case can be only an inference or surmise. Orfila has observed blood in the cavities of the heart as well as in the lungs of exhumed bodies which had been for some time buried, the organs having a blueish slate colour ('Médecine Légale,' 4 ed. 1, 642).

The gases generated in the cavities of the head and face by putrefaction, appear to meet with the greatest resistance to their escape. The features become generally swollen or bloated, one or both eyes may be protruded, the eyelids swollen and dark-coloured, the lips swollen and the tongue protruded between them, gaseous matter with fluid escaping in bubbles from the mouth and nostrils. As the skin of the face is generally livid or even black, it is impossible, under these circumstances, to recognize a person. In death from drowning, when the body is afterwards exposed to a warm atmosphere, the gases of putrefaction are so copiously produced, that the head appears much larger than natural, and the skin of the trunk and limbs is distended with gas, giving to the whole of the discoloured body a bloated appearance.

Gases of Putrefaction.—The *gases* produced in the dead body are in the early stages chiefly ammonia and sulphuretted hydrogen, and at a later period carbonic acid, carbonate of ammonia, nitrogen, carburetted hydrogen, and phosphuretted hydrogen. The nature and quantity of these gases depend more on the degree of putrefaction than on the time which has elapsed since death. The sulphuretted hydrogen may be detected by paper moistened with a solution of acetate of lead; the phosphuretted hydrogen, by paper impregnated with nitrate of silver; ammonia, by the vapour of hydrochloric acid, or red litmus paper; and the carburetted hydrogen, by its combustibility and by the products of its combustion. It will generally be found that the sulphuretted hydrogen is combined with ammonia, since paper impregnated with a solution of nitroprusside of sodium acquires a crimson colour when held in a jar containing the decomposed viscera. Other gases and vapours, of which chemistry can at present render no account, are also present. On some occasions the exhalations have been of a most offensive and nauseous character, and the tests have not indicated the presence of either sulphuretted or phosphuretted hydrogen.

Dr. W. Lewis examined and reported on the external condition and appearance of 22,000 coffins accumulated in the vaults of London churches. He examined the state of the contents of about one hundred of these. The experiments were made on the bodies of persons of all ages, and on coffins which had been deposited for a short period or for upwards of a century. He did not find therein sulphuretted, phosphuretted, or carburetted hydrogen, or any compound of cyanogen. The gases which he uniformly detected in the coffins and the vaults were nitrogen, carbonic acid, and atmospheric air holding decomposing animal matter in suspension. Ammonia was occasionally found in large quantities; this, when present, overcame all other odours. When absent, the animal matter had a smell resembling that of putrid moist cheese. He opened one leaden coffin, in which the corpse had been enclosed for nearly a century; the ammoniacal gas which escaped from it formed dense white fumes when brought into contact with hydrochloric acid gas. It was so powerful that the head could not remain near it for more than a few seconds at a time ('Amer. Jour. Med. Sc.' Jan. 1852, p. 275). I have noticed the same results in reference to a body which was exhumed after six months' interment. When the coffin lid was removed by the side of the grave, a large quantity of fœtid ammonia escaped. On throwing into the coffin some chloride of lime, dense white clouds of the hydrochlorate of ammonia were evolved from the interior of the coffin, to the great alarm of some of the bystanders, who were not aware of the chemical changes produced. It would appear that the air enclosed in coffins is in general completely deoxidized. When tested it was not inflammable, but was found in every instance to extinguish flame. In leaden coffins putrefaction is so much retarded, that the remains of bodies were found after the lapse of a century. The metal is slowly corroded and changed into carbonate of lead.

Changes in the Viscera.—During these changes in the dead body, various discolorations take place on the mucous surface of the stomach and bowels, which often closely simulate the effects of disease or poison. The mucous membrane of the stomach may be found of various tints—from a red brown, becoming of a brighter red by exposure to the air, to a deep livid purple or slate colour, and sometimes black from a decomposition of the blood. At the greater end, where the stomach is in contact with the spleen or liver, the lividity is often well marked and clearly defined through all the coats. The peritoneal or outer coat is of a greenish hue, and the course of the superficial vessels is marked by greenish-brown or black lines. These spontaneous changes, which are the result of putrefaction, may be easily mistaken for the effects of irritant poisoning. There are no rules that I am aware of, which will always enable a medical jurist to distinguish such cases. Much must depend on the progress of putrefaction, and the period after death at which the body is examined: hence, each case must be judged by the circumstances which attend it. We may presume that the redness has taken place during life, and is not a result of post-mortem changes. 1. When it is seen soon after death. 2. When it is met with in parts not dependent, nor in contact with other organs gorged with blood. 3. When it is accompanied by a considerable effusion of coagulated blood, mucus or flakes of membrane, the result of ulceration, corrosion, or destruction of the coats of the viscera. When the body is not inspected until a long period after death, it is difficult to distinguish these pseudo-morbid appearances from those depending on the action of irritant poison. In a really doubtful case it is, therefore, better to withhold an opinion, than to express one which must be purely conjectural.

It is impossible to assign a definite period at which the effects produced by irritants are destroyed by the process of putrefaction. If the poison were of an antiseptic character, and the body had been speedily buried, a decided redness of the stomach, as a result of inflammation, may be perceived after five or six weeks. On one occasion I was able to distinguish the effects of arsenic on the mucous membrane of the stomach in the case of a child whose body had been interred for a period of twenty-eight days; and in other cases in which the viscera were well preserved, after a year and nineteen months. Of course, when the inflammation is only slight, it will be much more speedily obliterated, or merge in the redness caused by decomposition.

The effects of gravitation in leading to a discoloration of the stomach and bowels in the recently-dead body, must not be overlooked. The experiments of MM. Trousseau and Rigot have determined, that the simple effects of gravitation will produce a livid or even a red appearance of all the dependent portions of the intestines. This *cadaveric congestion*, as it may be termed, has been long known to exist in the lungs; but it does not appear to have attracted sufficiently the attention of pathologists, in respect to the stomach and intestines. It has been especially remarked by Andral and others, in the small intestines, particularly in those portions found within the cavity of the pelvis; and this last-mentioned pathologist noticed, that in a body placed with the face downwards soon after death, the anterior wall of the stomach became strongly reddened. As this effect of gravitation ceases, so soon as the blood coagulates by the cooling of the body, so does it follow that when the body has been a long time in cooling, it will be much more strongly marked.

The mucous membrane of the stomach and upper part of the small intestines often presents, during putrefaction, a yellowish or green tinge, depending on the transudation of the bile, or the colouring matter of the fæces contained in the colon. This must not be mistaken for the appearance of poisoning by the mineral acids. There is, in these cases, no softening or corrosion, and the throat and gullet are not implicated, as they are in this form of poisoning. So, again, melanosis in the stomach—*i. e.* a deposit of black colouring matter beneath the mucous coat, might be mistaken for the effect of sulphuric or oxalic acid or caustic alkalies; but melanosis is unaccompanied by any marks of inflammation or corrosion in the mucous membrane beneath, and it is always seen in well-defined spots.

Among the *external* changes produced by incipient putrefaction, a change of colour in the skin covering the abdomen, has been already noticed (p. 45). It slowly acquires a pale, green hue, gradually deepening and extending to the skin of the chest and limbs. This colour has been regarded, by M. Deschamps, as a most certain sign of death, and one better fitted than any other to guide us in determining the reality of death. This sign, however, is not available, under common circumstances, until three days after death, and it is scarcely possible that a well-informed practitioner should require to wait so long a time before expressing an opinion. M. Deschamps has laid down the following rules respecting this green colour acquired by the skin of the abdomen :—1. A greenish-blue colour, extending uniformly over the skin of the belly, is the only real and certain sign of death. 2. The period at which this sign appears after death, varies much; but it commonly takes place in about *three days*, under favourable conditions of warmth and moisture. 3. Although discoloration of various kinds and from various causes, may occur in other parts of the body, this characteristic mark of death is always to be found in the abdomen. 4. Apparent death can no longer be confounded with real death, the abdomen never becoming coloured green or blue in any case in which death is only apparent. 5. This colouring of the abdomen, the appearance of which may be artificially hastened by exposing the body to a warm temperature, will, if observed, entirely prevent the possibility of premature interment. 6. There is no danger to public health from keeping a body until the appearance of this characteristic sign of death.

There are some facts connected with the progress of putrefaction as it takes place in the atmosphere, in the earth, or under water, which are of interest to a medical jurist.

1. PUTREFACTION IN AIR.—Putrefaction cannot take place in the *living* body; it is in resisting the access of this process, that the power of *life* or vital force is chiefly manifested. Some have conceived that putrefaction might begin under a diminished state of vitality, as when a person is about to perish from a slow and wasting disease: they have thus explained the peculiar odour perceptible in the breath and perspiration of many dying individuals, some hours previous to dissolution. But it is probable that these exhalations are themselves of a morbid nature: at any rate, it is certain that so long as *life* remains in the body, no phenomena resembling those of ordinary putrefaction in the dead body are observable. It is unnecessary to make any remark in this place relative to local gangrene; since, although this may take place in a living body, it is only observed in a part already deprived of life, and does not involve the whole of the body. It is molecular or partial death.

In some cases, before dissolution, the breath has been observed to be luminous: this has been ascribed to the evolution of phosphorus, which is said to have been distinctly recognized by its peculiar odour. It would appear also, from good authority, that the countenance of a dying person has, on more than one occasion, become distinctly luminous or phosphorescent in the dark. The cause of this phenomenon is unknown, and, so far as I am aware, it has been only in advanced cases of consumption or wasting disease, that this evolution of light from the countenance shortly before death, has been observed (see cases by Sir H. Marsh, 'Edinburgh Med. Journal,' vol. 58, p. 497; and by Drs. Donovan and Stokes, 'Dublin Med. Press,' January 15, 1840). Dr. H. M'Cormack has reported the case of a child, aged sixteen months, suffering from dentition, in which the skin of the hips was observed to be luminous. There was no odour of phosphorus, and no application which could account for it, had been made to the skin ('Ed. Med. Jour.' vol. 66, p. 285). But the dead human body may become luminous under incipient decomposition. A remarkable case of this kind occurred in 1823–4, in the dissecting-room of the Webb Street School of Anatomy. The greater part of a dead body which had been dissected appeared luminous or phosphorescent in the dark. The cause of this evolution of light in the dying and dead, is not well ascertained: in the dying it may possibly be owing to certain chemical changes analogous to decomposition, commencing during life; while, in the dead, it may be due to the production of luminous matter of a phosphorescent nature. It is well known that certain kinds of dead fish and decayed wood become luminous in the dark. These singular facts, which have only been observed of late years, will account for many of the superstitions which formerly existed.

The time after death at which putrefaction commences, may vary from a few hours to many days and even weeks. It never begins until cadaveric rigidity has ceased, and therefore not until the muscles of the body have entirely lost their irritability. Whatever conditions of the body during life or after death may operate to cause the disappearance of muscular irritability, will *pari passu* accelerate rigidity and putrefaction, and *vice versâ.* There are three primary conditions which are indispensable to the establishment of this process in a dead body. These are: 1st, a certain temperature; 2nd, the presence of moisture; and 3rd, the free access of air. There are many other conditions of a secondary kind which may retard or accelerate its commencement, and, when established, may affect its progress and duration. These will be considered in their order.

Temperature.—The process is found to go on most favourably in a temperature varying from 70° to 100°. It will commence, other circumstances concurring, at any temperature above 50°; but at 32° it appears to be wholly arrested. The dead body may thus be preserved a considerable time in snow, ice, or in a frozen soil; but if, after removal, it is exposed to a temperature between 70° and 100°, the ordinary putrefactive changes are stated to take place with more than their usual rapidity. Adolph Erman states that the body of Prince Menchikof, one of the favourites of Peter I., was exhumed at Beresov, in 1821, after a burial of ninety-two years in the frozen soil of Siberia. Although so long a time had elapsed, the body had undergone but little change. The heart and some other parts, with a portion of the grave-clothes, were removed and sent to the descendants of the deceased ('Travels in Siberia,' vol. 1, p. 462). But a still more remarkable instance of the preservative or antiseptic power of cold, is exhibited in the discovery of the body of an ancient elephant (*elephas primigenius*) in a mass of ice at the mouth of the River Lena in Siberia in 1805 ('Quart. Journ. of Science,' vol. 8, p. 95). Some years since I saw a portion of the dried skin and long hair of this animal, the race of which was extinct before the historical period.

A low temperature is said to arrest putrefaction by congealing the moisture within the animal body; but this explanation is not of itself sufficient, since a body at 33°, has no more tendency to putrefy than one at or below 32°. The true reason seems to be, that heat is essential to the combination of the gaseous elements of the body during putrefaction, as well as to the existence of the gaseous products resulting from their union. At a high temperature, again, *i. e.* about 212°, putrefaction is arrested. The soft animal solids lose their water, become hard and brittle masses, and may now be exposed to the atmosphere without undergoing any further change. A heat between 100° and 212° may also speedily put a stop to the process, by causing a rapid evaporation of the water contained within the solids. They become thereby dried and coagulated. Thus it is that bodies buried in the hot and arid sands of Egypt are dug up, many years after interment, in the state of desiccated mummies, putrefactive decomposition having been long since arrested. The effect of temperature on this process is strikingly seen in the influence of season. A dead body exposed to air during summer, when the thermometer is above 60° or 70°, may undergo more marked putrefactive changes in twenty-four hours, than a similar body exposed for a week or ten days in winter. This is a fact which demands consideration, when an opinion is required to be formed, respecting the date of death of a body concerning which nothing is known.

Light has not been found to have any influence over the process.

The Presence of Moisture.—Unless the animal substance is impregnated with water or moisture, it is impossible that putrefaction can take place. The animal solids commonly contain sufficient water for the spontaneous establishment of the process. In a human body weighing 150 lbs., there are about 100 lbs. of water ('Brande and Taylor's Chemistry,' p. 831). The soft organs differ much from each other in respect to the quantity of liquid contained in them, and therefore in the degree in which they are prone to putrefaction. Thus the brain and the eye are in this respect contrasted with the teeth, bones, hair, and nails. The fluids of the eye are rapidly decomposed, while the teeth and hair may remain for centuries unchanged. The late Mr. Quekett examined a portion of dried human skin with hair upon it, which had been exposed for many centuries on a door of Worcester Cathedral, and also other portions taken from the church doors of Hadstock and Copford in Essex. He found upon them some hairs, which were proved by the microscope to be human, thus confirming the old tradition that the skins of persons who had committed sacrilege were nailed to the doors of the churches which they had robbed ('Edinburgh Monthly Journal,' July 1848, p. 63).

If the organic substance be deprived of its water by any means, putrefaction is arrested. Gay-Lussac found that flesh might be preserved for a considerable period, simply by suspending it under a bell-glass, placed in a dish of fused chloride of calcium. Albumen and gelatine, deprived of water, by chloride of calcium, have been kept in a dry state for a period of twenty years, during which time they have been exposed to air and a favourable temperature, without undergoing putrefaction. An excess of water, however, tends to retard and modify the process: thus, by allowing a current of water to fall on animal matter, it may be preserved for a length of time. Water appears to act in putrefaction as it does in numerous other chemical processes, by its dissolving power. It brings the minute atoms of organic matter within the sphere of their mutual attraction. In excess it seems to retard putrefaction by merely cutting off the access of air. By long contact it produces an alteration in the soft solids, converting them into a white substance.

Influence of Air.—Putrefaction may take place to a slight extent independently of air, but the process is soon arrested; and thus bodies sealed permanently in leaden coffins, may be found perfect and identified after very long periods of time. The products in all cases in which air is excluded, are chiefly of an ammoniacal nature.

Air operates by its free oxygen combining with the animal elements, and forming gaseous and liquid products. The only limit to this process of decomposition under a free supply of oxygen, is the loss of water by evaporation. Nitrogen, the other element of air, has no influence; it appears to be decidedly antiseptic, so that flesh may be preserved in it for a very long period without change, although heat and moisture are present. Orfila states that it is owing to this circumstance that the bodies of infants, exposed to the soil and atmosphere of privies, are sometimes slow in putrefying, nitrogen being a predominant element in the air of these localities.

In gaseous mixtures it is necessary to putrefaction that the oxygen should be *free* as in the atmosphere, and not chemically united to any other element. Thus carbonic acid and the deutoxide of nitrogen, especially the latter, since it will not admit of the approach of free oxygen, act as most powerful antiseptics. In a series of experiments on the properties of these gases in retarding putrefaction, I found in one that a large piece of fresh muscle was preserved effectually in a bell-glass of deutoxide of nitrogen, over water, for eighteen weeks; in a second experiment, for nineteen weeks; in a third, performed in 1842, for a period of thirty-two weeks, or 224 days; and in a fourth, for a period of seventeen months. The last experiment was commenced on October 27, 1862, and at the present period (March 1864) the muscle suspended in the gas retains its colour after eighteen months, and has undergone no change indicative of putrefaction. These experiments have been carried on under all variations of temperature, in a room not below 40° in the winter season, but which sometimes reached 80° in summer. As the vessel containing the gas was placed over water, the gas was of course always saturated with aqueous vapour. Two of the conditions for putrefaction were therefore present. Air only was removed. In some parallel experiments with air and oxygen, putrefaction had gone on to a full extent in eight or ten days. These facts show that oxygen in a free state, is eminently necessary for the destruction of the soft parts of the body by putrefaction.

The influence of the atmosphere is not merely confined to its affording oxygen. It modifies putrefaction, according to its dry or humid condition, and according to its state of rest or motion. Dry air retards putrefaction, since evaporation is increased. Humid air accelerates the process, by giving rise to an opposite effect. Air in motion, as a brisk wind, retards the process, since, *cæteris paribus*, evaporation is greater. Air at rest, as the calm still atmosphere of a close apartment, is, on the other hand, favourable to the process. On the whole it may be inferred that the conditions most favourable to the putrefaction of the dead body, are a temperature of about 70° in a humid and tranquil atmosphere.

It has been observed that when putrefaction has once begun in a part of the body, it has rapidly extended itself throughout the whole. It seems as if the first products acted as a kind of ferment, to induce chemical changes throughout the mass.

Modifying Conditions.—There are many circumstances which modify the progress and duration of this process, to the chief of which it will be proper to direct our attention:—

1. *Age.*—The bodies of infants and aged persons, all other circumstances being equal, decompose more readily than those of adults. In regard to infants, this is important to remember, as in a case of infanticide, a medical witness may be required to state the time at which the death of the child probably took place.

2. *Sex.*—The bodies of females are said to putrefy more readily than those of males. The cause of this difference is not by any means apparent, and probably it is inconsiderable.

3. *Peculiarity of Constitution.*—Difficult as it may be to understand how constitutional peculiarity can influence the putrefactive process after death, it nevertheless appears to be well established that such an influence is exerted. In persons of the same age and sex, dying of the same disease, and exposed in the same apartment, or interred in the same soil, putrefaction will be found to advance with different degrees of rapidity. The cause probably rests upon differences in the condition of the fluids and solids of the body, which cannot be detected by the ordinary processes of chemical analysis.

4. *State of the Body.*—Fat and flabby bodies are observed to undergo putrefaction more readily than those which are thin and emaciated. This probably depends on the greater quantity of blood contained in them. Connected with the state of the body, we may also mention the influence which wounds or bruises, or mutilations of any kind, have over this process. 'Those parts which at the time of death are affected by contused or incised wounds,

ecchymosis or extravasation, rapidly pass into a state of putrefaction. Thus, in examining bodies which have been subjected to violence during life, contusions and ecchymoses may appear greatly aggravated, unless the examiner be aware that such parts become more speedily decomposed.

5. *Influence of Disease.*—The bodies of persons who have died from acute diseases, have been observed to putrefy more readily than those of persons who have died from wasting and chronic disease. In the numerous examinations of the dead made annually at Guy's Hospital, Dr. Wilks has observed as a rule, that the bodies of those who have been long ill, and are emaciated, remain unchanged for a longer time than those who have died from acute disease ('Guy's Hospital Reports,' October 1863). It would appear as if some kinds of disease had either directly or indirectly a retarding influence over this process. It has been also remarked that the bodies of plethoric persons who have died suddenly while in good health, often undergo rapid decomposition. In persons who have died from asphyxia, as by drowning, suffocation, or strangulation, the bodies are, *cæteris paribus*, observed to putrefy with great rapidity; and as a general rule all those parts of the body which at the time of death are irritated, congested, or inflamed, are rapidly attacked by the putrefactive process.

6. *Influence of certain Poisons.*—The most contradictory statements have been made regarding the process of putrefaction in the bodies of those who have died from certain poisons. Thus it has been stated that in death from prussic acid, morphia and vegetable poisons, putrefaction generally commences early and progresses with rapidity, while strychnia has been supposed to exercise a retarding power. In poisoning by vegetable narcotico-irritants the blood is observed to be frequently dark-coloured and very liquid, and it may therefore have undergone some chemical change, which may render it more prone to decomposition. But the observations elsewhere made (p. 17) will at once account for the conflicting statements, and show that putrefaction may be accelerated or retarded under the influence of the same poison, according to the mode in which it operates on the muscular system at the time of death. Thus when strychnia destroys life rapidly, without exhausting the muscular irritability by frequent convulsive fits, putrefaction takes place slowly; but if all muscular irritability is destroyed before death, it speedily supervenes, and runs through its stages rapidly. As a general rule putrefaction is not set up in a body so long as cadaveric rigidity remains in the muscles. When this condition comes on late, and lasts for a long time, it is slow in appearing, whatever may be the nature of the poison: under opposite circumstances putrefaction takes place rapidly, provided the circumstances are favourable. In a death from nicotina in which all muscular irritability appeared to be destroyed, putrefaction commenced early and in a few hours had made great progress. The body was bloated, and the skin tense and much discoloured.

Some poisons, by chemically combining with animal matter, appear to confer on it the power of resisting putrefaction, at least to a very great degree. This is now a well-known property of arsenic; and in the arts, this poison is largely employed as an antiseptic. When a solution of it is injected into the arteries of a dead body, it tends to preserve it for a long time from putrefaction. In examining the bodies of persons poisoned by arsenic, after an interment of six, twelve, and twenty-four months, I have found the stomach and bowels remarkably preserved; and the liver, spleen, and heart also preserved, but in a less perfect manner. The preservative effects are occasionally such that I have seen the pathological changes in the mucous membrane, well marked after the body had been nearly two years in the grave. At the same time, it must be admitted that this preservative property is not manifested in all cases; hence we must not fall into the error of affirming that the person has not died from the effects of arsenic, because the viscera are much putrefied. The greater part of the poison may have been expelled before death, or only a small dose may have been given to the deceased.

These facts respecting the action of arsenic are now so well known to lawyers and medical men, that they are seldom disputed. Nevertheless in a trial for murder at the Lewes summer assizes, 1849 (*Regina* v. *Geering*), an attempt was made to refer the non-occurrence of putrefaction, in a case of poisoning by arsenic, to another cause. The deceased, Richard Geering, died on September 13, 1848, and his body was exhumed April 27, 1849, after an interment of rather more than seven months. When the coffin was opened, the face and upper parts of the body were much decomposed. The viscera which were sent to me were in a remarkable state of preservation. The substance of the heart was quite firm. Arsenic was found in well-marked quantity in all these parts. In the defence, a village undertaker was called to prove that, in burying the body, he had placed a slab of wood immediately above the coffin in order to keep the earth from it. An attempt was thus made to account for the preservation of the body irrespective of the action of arsenic. But this hypothesis was inadmissible. A slab of wood could scarcely affect the ordinary course of putrefaction in a grave; and if it did, it would influence it in all parts equally. In this instance those parts of the back only were preserved, in which arsenic was found: the abdominal viscera, which are commonly the first to undergo putrefaction in its ordinary course, were here less changed than the other organs of the body ('Med. Gazette,' vol. 45, p. 19).

Chloride of zinc, a powerful irritant poison, is another well-known preservative. It retards putrefaction apparently by combining with the tissues. In the case of *Ann Palmer* (*Regina* v. *Palmer*, 1856), whose body was exhumed after twelve months' burial, all the organs were found preserved; they contained antimony, which had penetrated even to the ovaries and the substance of the uterus.

7. *Accelerators of Putrefaction.*—It has been alleged that there are certain chemical substances which have the property of accelerating the process of putrefaction: and among these *lime* has been particularly mentioned. The strong mineral acids and alkalies in a concentrated state, act powerfully as solvents of the soft structures of the body: but they destroy it by immediately corroding it, and not by producing any changes in it analogous to putrefaction. Persons who have been guilty of murder have endeavoured, but ineffectually, to destroy the dead human body rapidly;—sometimes by attempting to burn it, and at other times by the use of nitric acid or lime. The attempt has generally failed. Dr. Webster endeavoured to dispose of the dead body of Dr. Parkman by employing various chemical reagents, but without effect. In the case of the Mannings (*Reg.* v. *Manning and wife*, C. C. C. October 1849), it came out in evidence, that the body of the deceased O'Connor was buried in a hole beneath the stone floor of a kitchen. The two prisoners, in order to destroy the body, poured over it a pint and a half of vitriol, and then covered it with fresh burnt lime, which was slaked upon it under the idea that this would rapidly destroy it; but the body was disinterred, and all the facts necessary to show that the deceased had been murdered, were clearly brought out. At the trial it was stated by one of the medical witnesses that lime would certainly cause a dead body to decompose more rapidly, that the features would be thereby much disfigured, and the brain reduced to a fluid state. This theory was set up in order to account for the apparently rapid putrefaction of the body, compared with the time that deceased had been

missing: but this was sufficiently accounted for without resorting to this hypothesis, by the season of the year (August) and the superficial interment. The medical opinion here given regarding the effect of lime, was in accordance with a popular view which appears to be incorrect. Some years previously to the trial of the Mannings, the dead body of a child, placed in a box and covered with lime, was brought to me for examination in reference to a charge of infanticide. Considering the period of death and the season of the year, the body was in a better state of preservation than might have been expected. The abdomen and lower extremities, which had been completely covered with powdered lime, were very well preserved. There was nothing to show that the lime had exercised any accelerating influence. On the contrary it had probably retarded putrefaction by keeping off air. A stiff cream of lime has no corrosive or caustic action on the skin or muscles: its chief use in the tanning of skins, is not to corrode them, but to combine with and remove the fatty portions. Comparative experiments were performed with powdered lime, partially slaked by exposure, on portions of raw flesh. The flesh acquired a greenish colour on the outside, but was speedily dried by the action of the lime, and after five weeks it was found that putrefaction had become arrested, and the flesh was harder and firmer than a similar portion which had been exposed to air during the same period ('Med. Gazette,' 1850, vol. 45, p. 20). Dr. John Davy from the results of his experiments has arrived at a similar conclusion. With the exception of cuticle, hair, and nail, which were softened by the action of wet lime, he found that this alkaline earth did not exercise any destructive or corrosive power on animal substances generally, nor one promoting their decomposition. On the contrary, in the dry state, it exerted a preservative and decidedly antiseptic power, arresting putrefaction even after it had commenced ('Med. Gaz.' Jan. 1850).

2. PUTREFACTION IN THE EARTH.—Exhumations are occasionally required for the purposes of justice, and it is under these circumstances that opportunities may occur for observing the progress of putrefaction in the dead. Unfortunately the results of these observations have hitherto led to no satisfactory conclusion; for sometimes one body has been found more decomposed after six or eight months' burial, than another which has lain interred for a period of eighteen months or two years.

From facts hitherto collected, especially from the researches made by Orfila, it would appear that the changes which take place are similar to those described in speaking of putrefaction in air. There is in the first instance a discoloration of the skin of the abdomen, owing to decomposition taking place more readily in the contents of the viscera. The skin of the whole body becomes green, and the epidermis is loose and easily detached by pressure or friction. The muscles also acquire a dark green colour, are more or less pulpy, and in the course of time lose their fibrous character. The lungs are distended with gases, and completely fill the cavity of the chest. The heart and liver are softened, and acquire a dark slate colour. The same change is observed in the spleen and kidneys—the fat around the latter organs being commonly white and firm. The whole of these organs will be found much reduced in size; thus the liver may weigh no more than a pound or twenty ounces. The surfaces of the soft organs, especially of the liver, frequently present small circular patches of a hard white crystalline substance, which is insoluble in water. It consists chiefly of crystals of phosphate of lime with organic matter, and in some instances associated with the phosphate of ammonia and magnesia. I have found these crystalline deposits in bodies which have been exhumed at periods varying from one to three years after interment. When the process is farther advanced, the soft organs are filled with bladders of air, and float on water. The stomach, intestines, and urinary bladder have their mucous surfaces stained with patches of a brown, green, or deep slate colour. Sometimes these stains are of a coaly blackness. The coats of the stomach, if entire, may be closely adherent. They are very thin, and are frequently ruptured in the attempt to examine them. All the contents may have disappeared with the exception of a thin layer of a black-looking substance, which is probably decomposed blood. The lining membrane is sometimes covered with deposits of small hard crystals of phosphate of lime, or phosphate of ammonia and magnesia. These must not be mistaken for crystals of white arsenic. The stomach and intestines may be stained of a deep orange or yellow colour with bile. This may be identified by its forming a green-coloured solution when boiled in hydrochloric acid. The marks of irritant poisoning, and those pathological changes in the viscera, which are so characteristic of death from poison, are now lost in the discolorations produced by putrefaction. As the process advances, the body becomes covered with fatty incrustations of a reddish-brown colour, and the interstices are filled with the common blue, white, or green mouldiness, intermixed with a reddish-coloured fungus. The skin and soft parts become thin, fall off in places, and expose the bones. The coverings of the chest and abdomen are so collapsed as to be in contact with the anterior portion of the spine. The muscles are considerably reduced in bulk; and they may be found in part converted into adipocere. The viscera are also much shrunk, collapsed, and often, if we except the stomach and duodenum, so intermixed, that it is not possible to identify or separate them. The liver may in this way be found incorporated with the lungs, owing to the destruction of the diaphragm; and the brain completely collapsed. In one exhumation, after four years' burial, the whole of the soft parts of the chest and abdomen, formed a soft whitish-yellow mass disposed in layers. It was impossible to distinguish the stomach from the liver, intestines, or lungs. The periods of time over which I have had an opportunity of examining exhumed bodies, have varied from one month to eight years. In the case of *Peter Mawer*, whose remains were exhumed at Boston in 1862, after eight years' burial in a damp grave, the body was in fragments, the soft parts loosely adhering to the bones, immersed in a large quantity of water in the coffin. The muscles, soft organs, and skin were converted into a white sodden mass, in which no organ or part could be identified. The mass had a fibrous structure: it contained oily matter, and had a very offensive odour like decayed cheese. The bones were of a dark colour: they could be drawn perfectly clean out of the soft parts. The water of the coffin contained phosphate and sulphate of ammonia, with animal matter.

At this period the features are entirely destroyed, and the form of the skull and skeleton generally, is apparent. In a still more advanced stage, scarcely any traces of the soft organs are to be met with. The muscles, if not already changed as above described, pass to the condition of brown foliaceous masses. This is chiefly observed in those bodies which have been buried in a dry gravelly soil. The bones are disarticulated, the long bones giving the perfect outline of the skeleton, while the short and flat bones, including the bodies of the vertebræ with the base of the skull, are converted into a brownish-white pulverulent mass, mixed with the friable remains of the wooden coffin in which the body was buried.

It has been found utterly impossible to assign any definite period of time to these changes, or, from an observation of them, to give any certain opinion respecting the length of time which a body has been interred. The reason is obvious: bodies undergo these changes with very different degrees of rapidity, even when they have been interred under similar circumstances. In one body, buried for a period of nine months, and in another for thirteen months, there were no traces of the coverings of the abdomen to be discovered; in a third, these coverings were found almost entire after a burial of twenty-three months; yet these three bodies had been wrapped in cloth of the same texture, and buried by the side of each other in coffins of the same kind of wood (Orfila).

It is commonly said that the soft parts are entirely destroyed in a period of from seven to ten years; but this must depend on the circumstances under which the body is buried, *i. e.* the kind of coffin, the nature of the soil, and the depth of the grave. Devergie states, that in one instance he met with no trace of a shroud in a body which had been buried three years and a half, while in another a portion was discovered after seven years' interment. I had an opportunity of examining a grave in which a body had been buried twenty-five years. Soft fragments of the coffin of a dark brown colour were found but of the body only the skull (excepting the base) and some portions of the long bones, remained. In an adjoining grave, nearly the entire skeleton was discovered lying at full length, surrounded by the decomposed coffin. This was after thirty-four years' burial, and the bones were nearly all perfect. I also found here traces of the shroud on the inside of what had been part of the coffin-plate, and the texture of linen was made evident by submitting it to the microscope. Unless the body has been buried in metal, or converted into adipocere, it is not probable that any of the soft parts will be found, in a soil favourable for decomposition, after ten or twelve years. They may exist as a sort of unctuous fat mixed with the wood and earthy matter, but they are not likely to be in a condition to admit of identification. Perhaps the usual period for the destruction of the soft parts in thin wooden coffins, may be taken at about ten years.

In most instances of judicial exhumation the period of interment is well known, and no opinion is required of a medical witness on this matter. The only case in which he may be called upon to give an opinion, is where a skeleton or some bones have been discovered lying loosely in the soil. This part of the subject will be considered hereafter. Great embarrassment might exist in defining the period of interment in an unknown case, when a body has been buried in a coffin; but this does not, for obvious reasons, occur in practice. The bodies of those who have died by a violent death, are commonly buried superficially in loose ground without a coffin; hence the data obtained by examining the progress of decomposition of bodies placed in coffins, even if they were more precise, could rarely be available for practical purposes.

As the teeth, the bones, and the hair are among the most indestructible parts of the body, it will be necessary in an exhumation to look for any portions of these that may remain. They often throw light upon the age and sex of the individual, and serve to determine questions of identity.

The circumstances which modify the progress of putrefaction in the earth may be in some measure anticipated from what has been already said of this process in air. Among them may be enumerated age, constitution, state of health or disease, the kind of death, whether the body be mutilated or entire when buried, the period during which it may have been exposed to the atmosphere before interment, the nature of the soil in which it is buried, and the depth of the grave, with other circumstances, the precise influence of which it is difficult to estimate.

There are a few special conditions which may affect the decomposition of bodies buried in the earth: — without a knowledge of them a witness may be led to express an erroneous opinion. The most important are—

1. *Period of Interment.*—It is well ascertained that a body putrefies much more rapidly in air than in any other medium; hence, if it be kept long

exposed before it is interred, putrefaction will take place much more readily, and advance to a much greater extent, than if it had been buried soon after death. On this subject it may be remarked, that, if a body be kept exposed during the summer for five or six days, and then interred, it may be found on exhumation after the lapse of a month, that putrefaction is as far advanced as it would have been after the lapse of several months, supposing that the subject had been interred within a few hours after death. Owing to this circumstance there is a difference in the rapidity of decomposition according to whether the bodies on which the observations have been made, were interred after exposure to a hot and moist, or cold and dry atmosphere. It has been already stated, that the period at which cadaveric rigidity of the muscular system ceases, is that at which putrefaction may be considered to commence. Many circumstances have been pointed out, which retard or accelerate the access of this condition of the body. When cadaveric rigidity has been retarded by any of the circumstances mentioned, the putrefactive process will necessarily be a longer time in making its appearance. When the rigidity is a speedy consequence of dissolution, we may expect that putrefaction will take place rapidly.

2. *Deposition of Ova by Insects.*—According to Orfila, there are no fewer than twenty species of insects which deposit their ova on the surface of the dead body; and the larvæ produced from these ova, rapidly assist in the decomposition and entire destruction of parts. Among these, the *musca tachina simplex* and *carnaria* may be particularly mentioned. For a short period after death, flies and other insects, even of a parasitic kind, seem to avoid the body; they rarely approach it or deposit their ova upon it until putrefaction is about to commence. When these ova are once deposited, larvæ are speedily produced from them, and decomposition now rapidly advances. The development of these insects commonly takes place with such rapidity that the surface of the body as well as the outlets, if the temperature of the atmosphere be at all high, becomes very soon covered with ova and larvæ. It is obvious that the development of many thousands of these ova may not take place until the body is placed within the grave; and, when interred under these circumstances, it will be found, on exhumation after a given time, to have run through the different stages of decomposition with much greater rapidity than another body, the interment of which may have taken place before any ova were deposited. Admitting the correctness of these observations, a medical jurist may expect to find that a body, interred during summer, will, after a given time, have advanced to a greater degree of putrefaction, than one which was interred during winter, all other circumstances being equal.

3. *Nature of the Soil in which the Interment takes place.*—If the ground is elevated or on an acclivity, it will commonly be dry, and decomposition will be retarded: if the body is buried in a low situation, or in a valley, the soil being generally damp, decomposition will be hastened. A dry and absorbent soil will invariably retard putrefaction: and thus, bodies buried in the sands of Egypt become often perfectly desiccated, and resist the process for a long series of years.

The chemical nature of the soil, also, has an influence, which may be briefly stated. In sand, gravel, or chalk, putrefaction goes on more slowly than in other soils, and adipocere is rarely met with, unless there be free access of water, when that portion of the body exposed to the current may become adipocerous. In marl or clay, if air has access, the process takes place more quickly, especially in loose mould or in any porous soil much impregnated with animal or vegetable matter. It is in these last-mentioned soils, provided they are not too dry, that the formation of adipocere is most abundant; and it is important to observe, that, however great the rapidity with which putrefaction may have advanced previously, it is either suspended or modified on the occurrence of this change. By a reference to the nature of the soil, therefore, we may often explain why a body, after having been interred for a considerable number of years, may be exhumed apparently unaltered by decomposition. The whole of the soft parts may have become converted into this white substance; but although the physical outline may be preserved, the texture of the organs will be completely changed.

4. *The Depth of the Grave.*—Observation shows that the deeper the grave, *cæteris paribus*, the longer putrefaction is retarded. This may depend upon several circumstances: as the want of a free access of air in deep graves, and the uniformly low temperature which is known to prevail, at all seasons of the year, at a certain depth below the surface of the soil. Bodies buried in shallow graves are subject to all the fluctuations of temperature which take place during the day and night, and throughout the seasons of the year; they are therefore most favourably placed for the rapid progress of putrefaction. According to the most accurate observations, the diurnal changes of temperature extend to about three feet in depth below the surface, while the monthly changes are perceptible to the depth of six feet. Bodies buried below this depth putrefy slowly, *cæteris paribus*, owing to the uniform and comparatively low temperature which is there maintained. As in these cases, there is no free access of oxygen, ammonia and sulphuretted hydrogen are abundant products of decomposition. The exposed parts of the skin are soft, completely brown like the skin of a mulatto, and the limbs, as well as the face, are thickly covered with a soft white fungus. Such has been the condition of bodies of which I have witnessed the exhumation, after an interment of from one to two years.

5. *The State in which the Body is buried.*—Putrefaction is more rapid in bodies buried naked, than in those which have been buried wrapped in clothes. This point may be a subject requiring especial attention in investigations relative to infanticide, since the bodies of children are usually thrown naked into a pit, and loosely covered with earth. The process is less rapid when the body is interred in a close coffin: and when the latter is formed of an imperishable material, such as lead, closely sealed, putrefaction is speedily arrested; and the deceased may be recognized after the lapse of many years. The reason why bodies are comparatively preserved under these circumstances, is obviously owing to the access of air being cut off. Any confined mass of ir, so soon as the whole of the oxygen contained within it, is removed by ombination, acts antiseptically, forming an atmosphere of nitrogen which etards putrefaction, and thus the body may be preserved for a long period.

The soil of privies and cesspools, according to Orfila, retards putrefaction onsiderably; but this is not in accordance with the observations of others, r with recorded facts.

Formation of Adipocere. Saponification.—In the course of these observaions, I have had frequent occasion to speak of the dead body becoming ometimes converted into adipocere: it will be therefore proper to explain hat is meant by this process of conversion.

The substance called *adipocere* was first observed and described by Fourroy during the removal of vast numbers of bodies from the Cimetière des nnocens in Paris. He gave to it this name, owing to its properties being ntermediate between those of wax and fat. He considered it to be constituted f fatty matter and ammonia. From an analysis by Chevreul, the substance escribed by Fourcroy was proved to be a real ammoniacal soap with some xtraneous colouring matter, which gave it a yellowish or brown colour. It contained, besides, a bitter substance not defined, and an odoriferous principle, to which it owed its smell. Chevreul also detected in some specimens, lime, potash, and salts. The composition of adipocere does not appear to be uniform: it is liable to vary according to the nature of the medium to which the body has been exposed. Thus, in hard or river water, the white substance so called, discovered in the dead body, is formed of a base of lime: so, in bodies laid in graves or vaults which are traversed by springs of water containing sulphate or carbonate of lime, an adipocere of stearate and oleate of lime is found as a hard white solid. It is not improbable, as Orfila has suggested, that in the first instance an ammoniacal soap is produced, and that this is subsequently converted into a calcareous soap by contact with calcareous water. Indeed, Orfila states that he experimentally established this point, by placing ammoniacal soap in maceration in a solution of sulphate of lime. In three weeks, he found that the calcareous, had become substituted for the ammoniacal base.

Any part of the human body may undergo this change, but all parts are not equally susceptible of it. In order that the adipocere described by Fourcroy should be found, it is indispensable that the animal fat should be in contact with substances containing nitrogen. Experiment has clearly established, that neither pure fat, nor pure fibrin, when kept apart will become saponified. Orfila found by comparative experiments, that the skin deprived of all fat did not undergo this change; but when the fat was allowed to adhere to it, it became saponified. Upon the knowledge of these facts, the following theory of the production of adipocere was founded. The fat containing no nitrogen, could not furnish ammonia; consequently it could not spontaneously change into this substance. The fibrin of the muscular system was therefore supposed to produce ammonia, by giving off hydrogen and nitrogen; and this alkali combined with the fatty acids of the body to form a soap (see 'Ure's Dictionary, art. Adipocere'). Devergie has shown, that the fat of the female breasts, that of the hollow of the cheeks, and other large fatty accumulations, are the first to take on this change, while the fatty layers immediately in contact with the muscles, present no appearance of saponification, until a considerably later period. We have observed this change in a body after interment for a year, in the fat of the kidneys and omentum, as well as in the fatty appendages of the large intestines. As the fat of the body is contained in a cellular membrane (a nitrogenous compound), and is traversed by the blood and other nitrogenous fluids, the nitrogen is as readily furnished by these, as by the fibrin of the muscles. So, again, the skin and fat, separated from the muscles, will become converted into adipocere. The fibrin of muscles, is therefore, although unquestionably it may be one source of the ammonia, is not the sole source. Oil or fat exists throughout the soft organs and tissues of the whole body; hence every part may undergo this transformation. When the change is complete, the body maintains its condition for many years. Thus, in one instance, after seventeen years' burial in a grave, an exhumed body was found to be converted into this substance, and many of the organs could still be identified ('Phil. Med. Exam.' April 1847, p. 247).

This process takes place most readily—1. In the bodies of young persons, the fat being chiefly external and very abundant. 2. In those adults whose bodies abound in fat. 3. In bodies exposed to the soil of water-closets. 4. In those immersed in water, but somewhat less rapidly in stagnant than in running water. 5. Readily in humid and fatty soils, especially in graveyards, where numerous bodies have been piled in contact with each other. In this latter case, those which are situated at the lowest level have been observed to become the soonest saponified. The period required for saponification to take place varies according to circumstances. Devergie states that the body of a newly-born child in the soil of water-closets may become entirely saponified in from six weeks to two months; while in a drowned subject in water, saponification may be partially met with in three or four months; and in one buried in a damp grave, from two to three years may sometimes elapse before saponification is complete. There is no doubt, however, that the process may take place partially in the dead body, within much shorter periods than these. A body floating in water has been found converted into this adipocerous state in a little more than five weeks; and with regard to the period in an ordinary grave, I may refer to the case of a female, exhumed at Bristol, in 1835, after fourteen months' interment. The lower part of the body was here found adipocerous. It appears that the grave was very damp, and the line of adipocerous transformation in the deceased was bounded by the level to which the water had reached. These facts are of more importance than may at first sight appear, since a legal question of survivorship, in at least two cases, has turned upon the shortest period required for the production of true adipocere in the dead body.

Properties of Adipocere.—Fourcroy and other French chemists describe adipocere as an unctuous, soapy substance, varying in colour from a pale white to various shades of yellow or brown. In the first instance it is soft, but becomes harder and lighter in colour when dried. It melts at 200°, and when strongly heated in air gives off an ammoniacal odour, inflames, and burns. It is easily suspended in cold water, and forms an opaque mixture on boiling. Acids decompose the solution by combining with the bases, forming salts. When heated with lime, ammonia is evolved. It is only partly dissolved by boiling alcohol. Adipocere with a calcareous base is harder and whiter than that which contains ammonia. There is no trace of organic structure in either.

Having had an opportunity of examining this substance as it is found in bodies after long interment in damp graves, I here subjoin a description of its properties. A man named *Peter Mawer* died and was buried at Boston in October 1854, and his body was exhumed for judicial purposes in June 1862. I have already described the condition in which it was found after an interment of eight years (see page 60). The white substance into which all the organs had been completely transformed was unctuous to the touch, and had a peculiar and highly-offensive odour. When completely dried it was soft, white, somewhat brittle, with a fibrous structure, and crumbled under the knife. Examined by the microscope, it presented none of the usual characters of muscular fibre. It appeared to be a confused network of fibres cemented by a white, fatty-looking substance. It had a disagreeable rancid odour, which was increased when the substance was heated. It was in great part dissolved by alcohol, and the solution became opaque on adding to it water. It readily floated on water, forming an opaque solution when boiled: the greater part was dissolved, but the liquid did not become clear on filtration. The solution had a slight acid reaction on litmus paper. When heated with potash, it became clear, and evolved ammonia. The substance was almost entirely soluble in potash, and the solution gave a white precipitate with acids. The potash solution gave no trace of the presence of sulphur. It formed a red-coloured liquid when boiled in strong hydrochloric acid. It was carbonized by sulphuric acid. The aqueous solution contained no sulphuric or phosphoric acid or lime: it contained an abundance of alkaline chloride with animal matter which reduced nitrate of silver. It was only partially fused at 212°. When heated in a close tube, it gave out an offensive rancid odour; it evolved ammonia and traces of sulphur; it readily melted, and by continuing the heat, a dense oily vapour having an acid reaction was distilled over—a carbonaceous residue being left in the tube. When heated on platinum, it melted, took fire, and burnt with the bright yellow flame of hydrocarbon. It left a mineral residue of a brownish colour owing to the presence of oxide of iron: this residue amounted to five per cent. of its weight. The residue was in great part soluble in water, the solution having a strong alkaline reaction and effervescing with acids. It contained the carbonates of potash and soda, with phosphate of lime and chloride of sodium, as well as traces of alkaline sulphate and oxide of iron. Adipocere, therefore, does not appear to be a definite compound. It is a variable mixture of the fatty portions of the body with altered organic tissues. It contains in a concentrated form, besides ammonia as a result of decomposition, the bases as well as the salts which are found in the animal solids and fluids. These appear to be intimately combined with the fatty portions of the tissues.

CHAPTER 5.

INFERENCE OF THE PERIOD OF DEATH IN A BODY AFTER PUTREFACTION — INSTANCES OF RAPID DECOMPOSITION OF THE BODY — PROBABLE CAUSES — DETERMINATION OF THE TIME OF DEATH — PUTREFACTION SUSPENDED: CASE OF DESHA — PUTREFACTION ACCELERATED — CASES OF MRS. BYRNE AND JOSEPH MAHAIG — MARKS ON THE SKIN — PROTRUSION OF THE EYE AND TONGUE, AS A RESULT OF PUTREFACTION OR STRANGULATION — PUTREFACTION IN WATER —PERIOD OF IMMERSION IN WATER.

Inference of the period of death in reference to a body after Putrefaction.— Orfila, after having devoted many years to the investigation of this subject, and after the comparative examination of some hundreds of exhumed bodies, of all ages, and of both sexes, came to the conclusion, that it was beyond the reach of science to determine with accuracy the period of death, from the progress of putrefaction. Bodies which had been buried for an equal length of time in the same soil, and under apparently similar conditions, frequently presented such differences, as to baffle all attempts at generalization. This question becomes even more difficult, when the body is submitted to examination, and none of the conditions under which the person has died, or to which the body has been exposed since death, are known. It will be perceived from what has been already stated, that the circumstances which affect the rate and progress of putrefaction, are numerous and of a variable character. If we can obtain no history of the case, a medical opinion can be little more than a conjecture; if, however, we are informed of the atmospheric and other conditions to which a dead body has been exposed, it may then be in our power to arrive at a probable, if not a definite conclusion. In the description of the modifying conditions above given, the practitioner will find some points which may render him assistance, or, at any rate, enable him to avoid some of the serious errors which have been made by medical witnesses in reference to this subject.

It has been elsewhere stated, that putrefaction does not commonly commence, until about the third day after death, at any rate there is usually no external sign of the process until that date; but there are many instances known of its commencing almost immediately after death, and proceeding with great rapidity, while, in other cases, more than twenty days have passed, without any manifestation of its appearance (page 36).

The experience of my colleague, Dr. Wilks, who has for many years conducted the post-mortem examinations at Guy's Hospital, and who has had an opportunity of inspecting about four thousand dead bodies, may be here briefly referred to. At Guy's Hospital, most cases are inspected within twenty-four hours after death, when, as a rule, the body is rigid, and no decomposition has taken place. If after two or three days much change should be present, it is generally to be attributed to some peculiarity in the cause of death. The decomposition is not shown, as at a still later period, by a mere change of colour, as a greenish hue of the abdomen, but by a redness of the whole body, and by dark stains in the course of the superficial veins. Even when these external changes are scarcely observable, there may be found considerable alterations within the body, shown more especially by discolouration of the heart and arteries from the blood. These changes appear to be connected with a diseased state of the blood, and are met with in those who have died of fever, pyæmia, and similar maladies. In cases of strangulated hernia, in which death speedily follows an operation, the post-mortem changes are sometimes observed to be very rapid. It is a common observation, that moisture in the atmosphere appears to favour decomposition much more than heat; thus putridity is much more rapid on a moist winter's day than on a hot dry day in summer. These facts may be illustrated by cases from the records.

1. In September 1855, the body of a man who had been killed, was examined thirty-eight hours after death; it had begun to undergo decomposition in the ordinary manner. The body of another man, who had died of phthisis, was examined forty-four hours after death, and in this there was no trace of decomposition. On the following day an inspection was made of the body of a man who had died in a few hours after fracture of the ribs. Only forty-eight hours had elapsed since death, but considerable decomposition had already taken place.

2. Sometimes decomposition is so rapid that in a few hours the features of a person are unrecognizable. A man, æt. 26, died on November 28th, 1855, of typhoid fever, and perforation of the ileum. The weather was cold and moist. When the examination was about to be made, in sixteen hours, the body was wholly unlike that of the man when alive. There was no rigidity; he whole body was bloated; the cellular tissue was greatly distended, so that when the skin was pierced the gas which escaped was easily ignited into a lame. The colour of the surface was of a reddish hue. The internal organs were also much decomposed; of a dark colour, soft, and emitting a very fetid odour. The liver was full of air. The patient was a temperate man, residing in the country.

3. A man, æt. 35, shot himself with a pistol, producing fracture of the skull and injury to the brain, from which he died in six days. On December 13th, 854, the atmosphere being cold but moist, the body was brought into the room for examination, thirteen hours after death. The rigidity was imper-ect, but still present to a slight degree; the body was warm; when opened, showed that a remarkable change had taken place internally, so that it was ven suggested whether decomposition had not commenced during life. The rain, besides being sloughy, was rapidly decomposing; the lungs showed an arly inflammation, and the tubes were deeply stained by imbibition; the terior of the heart and arteries was of a dark-purple colour, and the clots in e heart were mixed with air; the peritoneum was discoloured; the liver esented a very remarkable appearance, it was full of air, and thus resembled ry much a mass of fermenting dough; on the surface were bubbles of air ady to burst: this organ contained two small pyæmic abscesses. The leen was of a greenish colour; the kidneys closely resembled the liver, being, e it, distended from decomposition, and containing air-bubbles throughout eir substance.—(See 'Guy's Hospital Reports,' October 1863, p. 181.)

In addition to these cases, Dr. Wilks has communicated to me another, in ich a man, æt. 50, died in Guy's Hospital, from an accident in December 60. He lost much venous blood, and, without showing any sign of rally-g from the accident, he died on the fourth day after his admission. For a few hours before death, he suffered from great difficulty of breathing, and his pulse was not perceptible. The man died at 6 P.M., and in an hour or two his body was carried to the dead-house. The weather was frosty, and it was a hard frost during the night that the body lay in the dead-house. On the following day (only twenty hours after death), putrefaction had advanced to such a degree, that the deceased could scarcely be recognized. The skin was throughout distended by the gases of putrefaction. All the viscera were decomposed, the liver contained putrescent gases, and even the coats of the gall-bladder were distended with them. This was a case of rapid death, probably from blood-poisoning.

The following is a remarkable instance of the rapidity with which putrefaction may take place in a dead body. A man, æt. 39, was admitted into Guy's Hospital in October 1849. He was fat, of pale complexion, and of intemperate habits. The muscles were flabby. He died suddenly after a few days, without suffering from any symptoms indicative of danger. His death took place at 10.30 P.M., the body remained in the ward until 8 A.M. the following morning, the air having a temperature of from 60° to 65°. The conditions as to cooling and rigidity were not observed during the night; but when removed at the hour mentioned, decomposition had already commenced. The skin on the left side was raised in large bladders, containing a bloody liquid. At 2.30 P.M. *i.e. sixteen* hours after death, the entire skin was more or less of a blue or purple colour; the eyes protruded from the sockets, and the nostrils were filled with a bloody froth, from which minute bubbles of gas continually issued. The abdomen, as well as the scrotum, was greatly distended with gas. The groins were much putrefied and were covered with minute bloodvesicles. I saw the body *seventeen hours* after death. The skin of the neck and face had then a bloated and tense appearance from the collection of gas beneath. Blue, green, and livid-red discolourations were seen more or less over the whole surface, with bladders or vesicles as in the advanced putrefaction of bodies after some days' exposure in hot weather. The gases which issued in jets from every part of the skin in which a puncture was made, were highly offensive. When a flame was applied to the puncture, the gas burnt suddenly, with almost explosive violence. The gas did not discolour slips of paper moistened with acetate of lead or nitrate of silver: hence neither sulphuretted nor phosphuretted hydrogen was present. It burnt like the bright carburetted hydrogen; and I believe that it was this gas, mixed with other gases and vapours derived from putrefaction. When the tense skin of the scrotum was punctured, a jet of carburetted hydrogen escaped, which burnt steadily, with a pale yellowish flame, for above a minute. The state of the body precluded a post-mortem examination, which was considered unnecessary ('Med. Gaz.' 1850, vol. 45, p. 17). This case resembles in its features one which occurred to Dr. Wilks. See case 2, p. 67.

The condition of this body in reference to the process of putrefaction was such as M. Devergie assigns to dead bodies at a period of six to twelve days after death, on the assumption that they have been freely exposed to the air, at a mean temperature ('Med. Leg.' vol. 2, p. 406). Had the body of this person been found in a house under these circumstances, and had the history of the case been entirely unknown,—a medical man, asked to assign a period of death, might, from common experience in such matters, have declared it to be impossible that the deceased could have been living within twenty-four hours previously to the discovery. Suspicion might thus have been removed from persons really guilty of murder, because it might have been proved that they had not been in or near the house until within a day of the discovery of the body. On the other hand, an innocent person who had been seen in company with the deceased five or six days previously, or who had voluntarily remained in the same room with the body, might be unjustly charged with having been accessory to his death. This, with other instances of a similar kind, shows that unusual caution is required in expressing a medical opinion on the time at which death took place, in bodies which are found much decomposed.

The causes of this rapid access and progress of putrefaction in the body of a man dying in the prime of life, cannot be assigned to the season of the year, or to the operation of any unusual external influences. It may have been due to the condition of the body, especially of the blood, at the time of death. This man was of intemperate habits, with a flabby muscular system, and low vital energy. These were precisely the conditions favourable to the speedy loss of muscular irritability after death, with the appearance and disappearance of cadaveric rigidity, after an unusually short duration. The fourth or putrefactive stage was therefore reached in a few hours. The ward temperature, 65°, was favourable to the process, and the blood and other fluids of the body were probably prone to decomposition. Although the body was removed into a cooler atmosphere on the morning following death, yet the process having once commenced, progressed with great rapidity.

The late Sir Henry Marsh has described a case of a somewhat similar kind. A man who had been ill about fourteen days, was admitted into the Hôtel Dieu, at Paris, under M. Bally. He died on the night after his admission; and on examination *eight hours* afterwards, his body presented the following appearances:—The whole of the skin was distended with air; it was of a violet colour, and studded with a vesicular eruption in detached spots, the vesicles being filled, some with a reddish-coloured serum, and others with gas. The abdomen was also much distended by gas, this having accumulated not in the intestines, but in the cavity of the peritoneum. Upon cutting into any emphysematous part, an inflammable gas escaped which was readily ignited by the flame of a candle. From a perforation in the abdomen it issued and burnt with a blueish flame (sulphureted hydrogen or carbonic oxide). ('Ed. Med. Journ.' vol. 58, p. 501.) It was thought this state of the body indicated putrefaction before death; but it was merely an instance of its rapid supervention after death.

The experiments and observations of M. Brown-Séquard, already referred to (page 17), tend to explain many of the supposed anomalies which present themselves in the commencement, progress, and duration of the process of putrefaction. The various physical and physiological conditions which affect muscular irritability, and, with this, cadaveric rigidity in a dead body, equally nfluence the process. The time for its commencement in a dead body is defined by the cessation of cadaveric rigidity, and this condition again has its commencement defined by the loss of muscular irritability. Some experiments on dogs, elsewhere related (page 17), show that when rigidity appears and disappears shortly after death, putrefaction is speedily manifested in a body, and it progresses with great rapidity. It has been long known that he flesh of hunted or over-driven animals rapidly undergoes putrefaction. Brown-Séquard, in September 1851, saw two sheep that had been over-riven to reach a fair. They were killed by the section of the carotid rteries. In less than five minutes after death rigidity was evident in both f them: and putrefaction was manifest before the end of the day, *i. e.* in less han eight hours after death ('Proc. R. S.' 1861, No. 44, p. 210). Whatver exhausts muscular power at the time of death, whether it be violent xercise, disease, or poison, tends *cæteris paribus* to accelerate putrefaction, nd to cause it to spread rapidly. Thus among persons killed by lightning r by strychnia, the body of one may putrefy rapidly, while that of another oes through the ordinary course. It is not due so much to the effect of the gent as it is to the mode in which it has destroyed life.

There is much difficulty in the practical application of these principles to the determination of the probable period of death, in reference to the body of a person found dead. Medical opinions are frequently required in cases of alleged child-murder, on the probable period of the death of a child, whose body has been found in a putrefied state. With a due regard to the conditions under which a body has been placed, a medical witness may occasionally be able to say whether its state was such as to be consistent or inconsistent with the delivery of an accused female at a particular period of time.

Greater difficulties occur on charges of murder in reference to the bodies of adults found dead under suspicious circumstances. The connection of an accused person with the act may occasionally turn upon the medical opinion respecting the state of the dead body. Dr. Beck furnishes a case illustrative of this statement. A man named *Desha* was charged with the murder of Francis Baker. The deceased was last seen with the prisoner on the 2nd November 1824. The body of the deceased was found on the 8th November, *i.e.* six days afterwards, in a sheltered hollow, with the throat cut, with several wounds on the head, and a wound on the chest. There was no doubt from the nature of the wounds that the deceased had been murdered, and that he must have died soon after their infliction. The defence of the prisoner rested to a great extent on the condition of the body when found, the principal question being, whether the state of the body was consistent with the suggestion of violent death caused *six days* previously. When discovered, it had undergone so little change that it was considered deceased must have been alive some days after the prisoner had been last seen in his company. The body when first found, is described as having been a little stiff; but after carrying it some distance it became pliant. There was no appearance of putrefaction about it, either by the smell or by any change of colour in the skin. In two days after its discovery, during which period it had been placed in a room in which there was a fire, putrefaction set in, and the abdomen and face became much swollen and decomposed. At this time *i.e.* the eighth day after the deceased had been seen alive, much blood issued from the wounds (page 49): according to one medical witness the wounds at this date appeared fresh, according to another they did not. There was some conflicting evidence, lay and professional, on the question whether putrefaction could be so completely suspended during eight days as it had been in this instance. The counsel for the prisoner dwelt upon the absence of the process as a proof that death must have been recent, and therefore that the prisoner could have had no share in it. The judge also inclined to this view. In addressing the jury he said, "It is difficult to suppose that a body, at this or any season of the year, could have remained that long without exhibiting some symptoms of putrescence: connect also that in two or three days after it was found, it did show such symptoms as in that time might naturally be expected." Another singular point raised in the prisoner's favour, was that the beard had grown after the discovery of the body, and it was quite short when it was first seen, and had the appearance of having been recently shaven; but in the interval of Tuesday and Thursday, after its discovery, it had become a little longer. Counsel contended that the beard will grow after death; and as, when the body was found, the chin was cleanly shaven this pointed to recent and not to remote death, as the beard would have already become elongated when the body was found, had the deceased been dead six days! The medical witnesses, in reference to this theory, stated that the appearance of growth after death was to be ascribed to a shrinking of the skin. The jury returned a verdict of guilty. The prisoner subsequently destroyed himself, and, while dying from his wounds, protested his innocence of this crime. ('Beck's Med. Jur.' vol. 2. p. 45). This case does not appear to present much difficulty. The fact that the body of deceased remained six days in a sheltered spot during the month of November, without undergoing any of the usual changes from putrefaction, is consistent with death six days previously. When found, the body had reached the third stage described by Devergie: it was cold and pliant, or readily became so: it had passed through the stage of cadaveric rigidity. According to the observations of Devergie, a dead body *cæteris paribus* would assume this condition in from three to eight days after death (page 45). The fact that putrefaction came on in two or three days after its discovery, although perplexing to the judge, is fully explained by the cessation of cadaveric rigidity and the warm temperature to which the body was then exposed. The condition of the beard did not justify the inference that death had been more recent. Neither the age nor the condition of the deceased's body is stated by Dr. Beck, but it is clear that he died suddenly from loss of blood, as well as other injuries. It may be inferred, therefore, that his muscular system was endowed with the ordinary amount of irritability. In cases of healthy persons suddenly killed by decapitation, Brown-Séquard observed that cadaveric rigidity did not appear until ten or twelve hours after death, and that it lasted more than a week when the weather was not extremely warm. The retardation of putrefaction in the above case may have been due to a similar cause.

The medical difficulty in the case of Desha arose chiefly from the suspension of the putrefactive process beyond the average period. Other cases have occurred, in which the rapid access of putrefaction following sudden death has implicated persons in charges of murder, and they have narrowly escaped conviction, apparently because the changes produced by putrefaction had been mistaken for the effects of violence.

In August 1842, Mrs. *Ellen Byrne* was tried at the Commission Court, Dublin, for the murder of her husband, Augustine Byrne, by strangulation, suffocation, or other violence (' The Trial of Mrs. Ellen Byrne, for the Murder of Mr. Augustine Byrne, specially reported by T. R. Dunckley,' Dublin, 1842). The prisoner and deceased, who were in a respectable condition of life, were in the habit of drinking to excess. On this occasion, they had retired to their bedroom, and about four days after the deceased had been last seen alive, and eight days after they had been in the room, the body of the husband was found dead on the bed, while the wife was in the room. She professed not to know her husband was dead, and sent for a medical man. From his evidence, it appeared that when he first saw the body on Saturday evening (July 9th) it was so much decomposed, that he was led to believe the deceased had been dead at least four or five days. The face and neck were black, and decomposition had gone on to such a degree in these parts, as to obliterate, it was believed, any marks of violence that might have been there at the time of death. The right eye was protruded—the tongue projected between the teeth to about half an inch: the ears were black, the lips were swollen, and the fingers were contracted. There was a frothy liquid issuing from the mouth and nostrils in bubbles, and living larvæ were seen in these parts. The whole of the body was greatly swollen, discoloured, and passing rapidly into a state of decomposition. When first seen, deceased was lying on his face. There was a faint, heavy smell in the room.

An inspection made the next day revealed the fact that putrefaction had taken place in all parts: but the head and neck were most decomposed—the black colour of the skin appeared to decline as it got down to the lower part of the neck. Internally the heart was empty, and the vessels of the brain were perfectly empty: the blood was fluid. Fæculent matter had been discharged from the bowels before death.

There were two medical questions in this case, on which the guilt of the prisoner rested: 1. When did the deceased die? and, 2. Was death to be ascribed to violent or natural causes? On Friday, July 1, eight days before his body was found, deceased had retired to his bedroom with his wife, and during that time a large quantity of spirits had been taken to the room and consumed by him, by his wife, or by both together. On Sunday, the 3rd, the voice of deceased was heard, as if he and his wife were quarrelling. On Monday they were not seen: on Tuesday (July 5th), a man-servant deposed that he was called upstairs by the deceased, who spoke to him, and gave him half-a-crown to fetch whiskey. He then heard deceased's voice, and saw his bare arm through the partly-opened door; but from the position in which he was placed, he could not see the whole of deceased's body. After this date, deceased was neither seen nor heard,—he was found dead on the evening of Saturday (July 9th), his body being then in the highly-decomposed state above described. On Wednesday (July 6th), prisoner left the bed-room for a short time, and closed the door. On Thursday (July 7th), and Friday (July 8th), she was seen at the door of the bed-room by the man-servant, and on the latter day by her maid-servant, and she was then quite sober, and spoke to them as usual. On Saturday (July 9th), at 10 o'clock in the morning, she ordered the servant to bring up *two* cups of tea. Between six and eight o'clock on the evening of that day, she suddenly called to one of her sons, to turn the deceased on his back. On entering the bedroom, he found deceased dead, and his body as above described. As the prisoner had been in the bedroom alone with the deceased, either living or dead, from the Tuesday when he was last seen, until the Saturday, she must, it was alleged, have been cognizant of his death, if it had not been directly caused by some act on her part. The prisoner made two statements: first, that she slept in the bed on Thursday and Friday, and that deceased died on Friday. She subsequently stated that he died on Saturday, the day on which the body was discovered.

From the state of decomposition of the body, two of the medical witnesses for the prosecution assigned a period of at least four or five days, during which deceased must have been dead. Two declined to give an opinion as to the number of days, and one (Dr. Geoghegan), the well-known Professor of Medical Jurisprudence in Dublin, stated his belief that such changes might take place in from twenty-eight to thirty hours. A medical witness called for the defence deposed that he had seen a body as much decomposed twenty-four hours after death. By reference to cases elsewhere related (page 68), it will be perceived that the shorter period assigned by these two witnesses, one for the prosecution and the other for the defence, is quite within the limits assigned by experience, although instances of such rapid putrefaction are not common. In this case, however, it must be remembered that the dead body was shut up in a close room, at the hottest period of the year, and the circumstances were therefore most favourable to the process. Admitting that this was an exceptional instance of rapid decomposition, the changes described by the witnesses might have occurred within twenty hours of the time at which the body was discovered, thus carrying the death to the night of Friday the 8th, at the time when prisoner was, according to her statement, in bed with the deceased.

The other question, as to the cause of death, gave rise to a conflict of opinion. On the one hand, it was alleged that the appearances in the body, *i.e.*, the black and decomposed condition of the head and neck, compared with other parts, the protrusion of one eye from its socket, and the projection of the tongue between the lips, as well as the absence of any natural cause of death, were medical proofs that deceased had died by strangulation and not by any disease or accident. On the other hand it was asserted that the deceased might have been accidentally suffocated while helplessly intoxicated, by falling with his mouth on the pillow, or that he might have been carried off by a sudden attack of apoplexy or epilepsy. The discolouration of the face, the protrusion of the eye and tongue, and the discharge of fæces, might be accounted for by his dying during a convulsive struggle; while the two supposed indications of strangling afforded by the eye and tongue, might be simply the result of the advanced state of decomposition in which the body was found. All the witnesses were agreed, that there were no marks on the neck to indicate death by strangulation; but this want of physical evidence was accounted for by some of them, on the theory that all such marks would be completely obliterated by putrefaction. The heart contained no blood, and the vessels of the brain were empty, the blood in the body was fluid and dark-coloured. The state of the lungs is not mentioned, nor the condition of the larynx and air passages, so that it is left uncertain whether any mechanical cause of obstruction existed in these parts. The emptiness of the heart, which was adverse to the theory of death by strangulation (asphyxia) was referred to the mechanical effect of gaseous putrefaction on the organ. The emptiness of the brain was left unexplained. It was inferred by most of the witnesses for the prosecution, that the marks of manual strangulation on the neck externally, and the usual appearances of asphyxia internally, had existed at the time of death, and that these appearances had been destroyed by putrefaction. Those who adopted this view, contended that the protruded eye and tongue were conditions which had resulted from strangulation alone, and that they could not be produced or removed by rapid putrefaction.

The guilt of the prisoner rested chiefly on these two points. The facts showed, even allowing no more than twenty hours to have elapsed between death and the discovery of the body, the prisoner must have been cognizant of the death; and, unless hopelessly insensible from drink, which appears to have been disproved by the evidence, she would, it was suggested, if innocent, have given an alarm. She ultimately called to her son, and no reason can be assigned why she did not call for assistance earlier. It was impossible to assume that she was speculating on the rapid decomposition of the body, and watching for the stage when marks of violence would be obliterated. No motive could be assigned for the murder, nor for her remaining shut up in the same room with her husband, as it was alleged, for four or five days. Under these circumstances, with the admission by some of the scientific witnesses, that the protrusion of the eye and tongue might have been caused by putrefaction, the jury returned a verdict of not guilty. There was nothing to exclude the supposition that the deceased might have died in a convulsive fit from epilepsy, as a result of excessive drinking. In any case, it was obvious that the body had undergone rapid decomposition. The greater decomposition observed in the head and neck might have arisen from the congestion of blood in the superficial vessels. As other causes besides manual violence may produce a congestion of the head and neck, the blackening of these parts in a highly-decomposed body furnished no medical evidence of homicide. The protrusion of the eye and tongue did not strengthen the theory of strangulation, since it was admitted by some of the medical witnesses that these conditions were consistent with the effects of putrefaction in an advanced stage. There was, therefore, no evidence of a medical nature to show that deceased had died by violence; and, instead of drawing the inference that such evidence had existed and had been destroyed by putrefaction, it would have been safer to have said that the highly-decomposed state of the body prevented any correct medical opinion from being formed. No opinion went the length of affirming that death was necessarily produced by violence;

and the jury were properly informed by the learned judge (Baron Pennefather) that they were not to convict the prisoner on probability, however strong, or on a mere preponderance of medical opinion.

The medical evidence at this trial raised the question whether a protrusion of the eye and tongue in a highly-decomposed state of the head and neck should or should not be regarded as an absolute proof of homicidal violence applied to the neck. One of the scientific witnesses affirmed that these states could not result from decomposition. Another deposed that they might result from gaseous decomposition taking place in the orbit; the gases thus confined would cause a projection of the eye and its coverings, while, in reference to the tongue, the effect of decomposition might be aided by the face being inclined downwards, and the mouth partly open. The fact that only *one* eye was protruded, does not appear reconcileable with the effect of mechanical pressure on the neck, while it would admit of explanation by the theory that decomposition took place from effusion of blood or other causes more in one orbit than in the other. With regard to the tongue, whatever causes congestion of the head and neck, is likely to cause congestion of this organ; and putrefaction, by the production of gas in its substance, may lead to its enlargement and protrusion.

It is strange that the protrusion of the eye as a result of putrefaction should have been doubted, and even denied, by some of the witnesses at this trial. So conflicting was the evidence regarding this appearance, that Dr. Geoghegan made it a subject of experiment on the dead body of a child, and he observed that the eyes protruded, as a result of decomposition, on the eighth day; they began to present the appearance of protrusion on the fourth day. A case of rapid putrefication, in which both eyes protruded as early as sixteen hours after death, was reported by me in the 'Medical Gazette' for January, 1850 (vol. 10, N. S. p. 17), see also *ante*, page 68. The time at which such an appearance presents itself after death, must obviously depend on the period at which gaseous putrefaction takes place in the orbits. Although, in the dead, the eyes are usually collapsed owing to transudation of the fluids, yet it has been pointed out by Orfila, that the lids may bulge forwards and the eyes protrude, from the production of gases within the cranium and orbits.

Events frequently repeat themselves in medical jurisprudence, and the same medical theories are again brought into conflict under similar circumstances. In December 1863, a trial took place at the Kingston assizes before Baron Pigott, involving questions almost identical with those which arose at the trial of Mrs. Byrne, at Dublin, in 1842 (*Reg.* v. *Mahaig*, Kingston Winter Assizes, 1863). On this occasion the body of a woman was found dead in a room in an advanced state of decomposition. The deceased and her lover, a soldier, had retired to a bedroom some days before, and had kept themselves there secluded: the soldier was found with his throat severely cut. This man was charged with the murder of the deceased, by strangling her with a rope, and the medical questions to be solved were: How long had she been dead? and, Did she die from strangulation, or any other cause? At the request of the Secretary of State, I attended the inquest and the trial on the part of the Crown, having made an analysis of the stomach in order to determine whether poison was present therein. Taking the two questions in their order, it may be observed that the medical evidence showed, that when the deceased was first discovered, on Friday, November 6th, at 6.30 A.M., she was lying on her back in bed, her body being covered with clothes as usual, the head and neck only being exposed. There was a pillow lying loosely over the face. There was no rigidity, and the hands were not clenched. The upper part of the body, including head, neck, and shoulders, was very much decomposed. The skin of the face was so black that the features could not be described. The tongue was protruded and swollen. The lips were everted and blown up with gas. Gases escaped from between the tongue and lips with a slight hissing sound. The abdomen was enormously distended with gas, and at the lower part much discoloured. On opening the cavity the intestines protruded. The liver was in a putrefied state. On cutting into the skin of the chest a large quantity of air escaped: the lungs were found collapsed, and the heart was empty and contracted. Owing to the putrefied condition of the body, the head was not examined. From the blackened and decomposed state of the upper part of the body, the medical witness formed the opinion that death had been caused by violence, and he inferred that deceased must have been dead for some time.

According to the evidence, the prisoner and deceased took the bedroom as a lodging at a public house on Tuesday, November 3rd. The deceased was seen on that night about nine o'clock, as well as the following morning, Wednesday, November 4. On the last occasion the landlady, who took the breakfast to the door of the room, saw her face in bed. She was lying still, and, as she did not speak, the witness could not say whether she was then living or dead. It was observed, however, that of the breakfasts taken up, which had been ordered for two the previous evening, only one was eaten. From that time deceased was not seen alive. The prisoner came down stairs on Thursday morning, 5th November, at nine o'clock. There was nothing unusual in his appearance or manner. He asked to borrow a razor to shave himself, but there was no razor in the house. Breakfasts were not taken up that morning; and the following morning, Friday, November 6th, as neither appeared, the room was entered, and the body of deceased was then found as described. The prisoner was lying on the bed with his throat severely cut: the wound had obviously been inflicted some hours, and had bled a great deal.

From the time deceased was last seen living (on Tuesday night), about sixty hours had elapsed. Considering that the weather was close and damp, and the body shut up in a small room, there was ample time for the putrefactive changes described, to have taken place; although such a degree of putrefaction is rarely seen until after the lapse of three or four days in warm damp weather. It was therefore an exceptional instance of rapid decomposition, like those elsewhere described (page 67). As the prisoner alone was in the room with the deceased, he must have been cognizant of her death; and yet he gave no alarm. His statement was, that they had both resolved to die; that they had purchased poison on Tuesday, the 3rd, and took it on the evening of that day, and that deceased died in his arms. In the afternoon, having left the room for a short time, he found on his return a cord round her neck, which he removed. The highly-decomposed condition of the body was consistent with his statements; for although one day might be sufficient for such changes, they are seldom witnessed in less than two days. This would place the death of the deceased on the night of Tuesday.

The main question, however, was this: Had the deceased been strangled by the prisoner on that night, or did she die from any other cause? The putrefied condition of the body was consistent with either hypothesis, and it was a strong circumstance against him that he had remained in the room with the dead body. There was, however, an entire absence of motive for the alleged murder. The prisoner and deceased had been apparently happy together. No quarrelling or struggling was heard at any time by the people of the house. There were no marks of violence on her person indicative of struggling or resistance. It was proved, as prisoner had stated, that the deceased had, on the 3rd November, purchased at a druggist's, under a false pretence, a threepenny packet of Butler's vermin-killer. This contains about one grain of strychnia, mixed with soot and flour; and the paper wrapper of this packet, with the empty bag which had contained the poison, was found in the prisoner's possession. Several letters written by the prisoner, one apparently at the dictation or with the cognizance of deceased, referred to their mutual intention to destroy themselves; and another, dated November 4, stated that deceased had taken poison and had died in his arms. With these facts there was strong reason to believe that the deceased had really taken the poison which she herself had purchased, and had died from its effects. Assuming that muscular irritability had been exhausted by violent tetanic convulsions before death, and that the deceased had died in one of these convulsive fits with great congestion of the head, the rapid putrefaction and the blackening of the features from the decomposed blood in the vessels, would then be explained. The empty and contracted state of the heart was also consistent with this view. The stomach was examined chemically by the medical gentleman who was first called in to see the deceased. He found it empty, containing only mucus with some black particles the nature of which could not be defined. It was at first thought that it contained strychnia, but on making an analysis of the remainder of the stomach, and the spirit in which it had been preserved, I found that it contained no strychnia, and that the chemical results which had led to this conclusion were owing to the colouring action of sulphuric acid on bichromate of potash in contact with organic matter. In the state in which the stomach was brought to me, cut into two portions and macerated in spirit; it was impossible to determine whether it had originally contained starch or soot (the substances with which the strychnia in the purchased powder was mixed), or gin (the liquid in which the prisoner said the deceased had taken the poison). This negative result did not show that the deceased could not have died from the effects of a small dose of strychnia (half a grain) such as would be contained in one half of the packet which she purchased: for such a quantity might have been readily removed by absorption, especially as the poison was taken on an empty stomach. The theory adopted by the medical gentlemen who examined the body was, that deceased had probably taken strychnia, but that, before the poison had had time to operate fatally, she had been strangled by the prisoner by means of a rope placed round her neck. This, in their judgment, would account for the contracted and empty state of the heart and lungs; they assumed that as the strychnia was in the system, it would prevent that accumulation of blood in these organs which is considered to be characteristic of death by asphyxia. Another suggestion was, that assuming strychnia not to have been taken by deceased, the empty condition of the heart and lungs might be accounted for by the effect of gaseous putrefaction in the abdomen (page 50). A few ounces of bloody serum were found in the cavity of the chest, but no blood was present in the heart or great vessels connected with it.

As the head was not examined, and the internal appearances of the chest did not support the theory of death by strangulation, it was sought to establish this view by the external appearances. Here, however, the same difficulty arose as in the preceding case. The advanced state of decomposition in the head and neck rendered the medical conclusions, to say the least, unsafe. The facts relied upon, to show that deceased had died from strangulation, were, 1. The black and decomposed state of the head and neck, compared with other parts of the body. 2. Certain marks found on the neck, at the upper part, and chiefly on the left side. 3. The peculiarly moist condition of the head and upper part of the neck, and the dryer appearance of the lower part, near the chest. 4. The enormous distension of the head, and the protrusion of the tongue between the lips.

The first and third reasons assigned indicate not the cause of death, whether by violence, disease, or poison, but simply an advanced stage of the putrefactive process, in a case in which death had taken place suddenly, and the conditions were favourable to putrefaction. The surgeon who first inspected the body found, on the day following its discovery, three marks on the neck, corresponding to three similar marks at the back part. There was no abrasion of the cuticle in front, nor any indentation or depression, but at the back the cuticle was peeling off, as the result of putrefaction, and serum exuded from it. On removing the integuments there was no appearance of escape or coagulation of blood beneath; and this is generally found in death from strangulation. The cellular tissue was much blown up with air (the gases of putrefaction). At the adjourned inquest before the coroner, while the facts were recent, the witness had thus described the appearances on the neck: 'On the external surface of the neck, there were two or three *indistinct* marks, most distinct on the left side. On removing the skin, there was not the least escape of blood, but here and there, the muscular tissue was more discoloured than the remainder.' Another witness, associated with this gentleman, who saw the body twenty-four hours later, described the marks as consisting of two or three lines of dark discolouration. There were no signs of violence beneath the marks, but the structures were of a darker colour below. He further stated that there was much blood in the subcutaneous tissue, from the chin to the chest; and on the arms there were apple-green streaks from putrefaction in the course of the blood-vessels. The protrusion of the tongue was referred by both, not to putrefaction, but to mechanical pressure on the neck as a result of strangulation.

A long clothes-line was found in the room, under the bed. This was proved to belong to the landlady, who stated that it had been lying a long time in the room, before it was let to the prisoner and deceased. On it was one small spot of coagulated blood, as if from a wound, and some long female hairs. When these were compared with some taken from deceased's head, there was found to be no resemblance. It was suggested for the prosecution, that this rope had been employed by the prisoner as the instrument of murder.

My evidence on this part of the case, the cause of death, was to the effect that, as the deceased was not seen in the act of dying, any medical opinion of the cause of death must be speculative, that there was nothing inconsistent with death from strychnia as alleged by the prisoner, while there were no medical facts on which the hypothesis of death from strangulation could be safely based. The internal appearances, so far as they were observed, were more consistent with death from strychnia, than with death from strangulation, a fact admitted by the two medical gentlemen who ascribed death to homicidal strangulation; that the non-detection of strychnia in the body was not inconsistent with the fact that a small but fatal dose had been taken by deceased; that a rigid state of the limbs in a dead body, would not be found where putrefaction had advanced to such a degree as in this case. Further, the external appearances did not prove that violence sufficient to cause death by strangulation had been applied to the neck of the deceased. The marks of discolouration on the neck, with the protrusion of the tongue, might have arisen from extreme putrefactive changes. Had the marks on the neck been produced by the application of a cord, such a degree of violence as would have caused the tongue to protrude would have produced indentation and depression of the soft parts of the neck, with an effusion of blood in the course of the depression, and a ruffling or abrasion of the skin.

On this part of the case it may be observed, that there was no protrusion of the eyes; that the tongue was not indented or bitten by the teeth, and the hands were not clenched as in death by violent strangulation.

It was suggested by counsel that strangulation might have been produced by other and less violent means than by the use of the rope, and the slight appearances thereby produced, might have been obliterated by putrefaction. It was admitted that this might happen, but there were no medical facts on which such an opinion could be based. The appearances were all consistent with putrefaction in an advanced stage, without resorting to the assumption that any violence whatever, sufficient to cause death, had been done to the neck. In the defence, it was urged that the prisoner and deceased had agreed jointly to take away their own lives: this was proved by the letters and their conduct. Deceased herself had purchased poison for this purpose, and had taken it, according to the prisoner's statement, on the evening of the day on which she procured it. Everything in the case was consistent with the theory of voluntary suicide, and of an attempted suicide by the prisoner in a state of despair. The powder containing the poison had disappeared, while the paper bag in which it was sold, remained.

In his charge to the jury, the learned judge observed that the great question for them to decide, was whether the prisoner had any part in the death of the deceased. If they were of opinion that her death was caused by the rope, and by his act, then their verdict must of course be wilful murder. If they thought that death was caused by poison, then they would have to consider whether the deceased took the poison without any participation on his part, in aiding and abetting her act, and if she did, then they must acquit him. But if, in their judgment, the two agreed together to take poison, and took it together, and she died, and he survived, then their verdict must be also wilful murder. The jury adopted this view, and found that the prisoner was guilty as an accessory before the fact, *i.e.*, that he was not guilty of murder by strangulation, but that he aided and abetted deceased in the voluntary act of self-murder.

The two medical gentlemen, while expressing their strong belief that death had been caused by strangulation, very properly admitted in cross-examination, that they would not swear that deceased had not died from strychnia or some other causes; and one of them stated that his reason for thinking that strychnia had not caused death was, none could be detected in the body. This, of course, was equivalent to affirming that unless some portion of an alkaloidal poison, whatever the quantity taken, remains unabsorbed in the stomach, death could not be ascribed to poison. This is not consistent with experience in such matters, and so far as this particular case is concerned, could not in the least degree affect the question whether deceased had or had not died from strangulation. It is obvious that a person may take a dose of strychnia, and yet, by the act of another, die from strangulation before the poison has been wholly absorbed, or before a quantity sufficient to cause death has penetrated into the blood. The discovery of some portion of strychnia in the stomach would not prove that the deceased had not been strangled, and its non-discovery, therefore, could not be taken as a fact in favour of death from strangulation. In short, this form of violent death should be clearly and conclusively established by medical facts, independently of the administration of poison. Here the cause of death was simply based on medical belief or probability; not on absolute certainty, which alone would justify a jury in coming to the conclusion that murder had been thus deliberately perpetrated. According to the prisoner's statement, the rope was really around the neck of the woman on Tuesday night, and he removed it. Assuming that the coloured marks on the neck arose from mechanical pressure, and not from putrefaction, it becomes a question whether the rope may not have been thus used by deceased, in attempting to strangle herself, or by the prisoner in aiding and abetting her in the attempt. Such a degree of pressure might be made on the part of the neck where those marks were found, without causing death, and this would account for their presence, without rendering it necessary o suppose that murder by strangulation had been perpetrated. The lescription does not convey the idea that it was impossible for deceased hus to have produced them, or that they could not have been produced vithout necessarily causing death; and thus there was literally nothing to upport the hypothesis of murder but medical conjecture.

It was stated in evidence, by one of the medical gentlemen, that if strychnia had been taken and death subsequently caused by strangulation, this fact would ccount for the absence of the usual appearances of asphyxia in the heart and ungs, *i.e.*, that strychnia would operate by producing a contracted and empty tate of the heart. Some questions on this point were put to me by the learned udge, in answer to which, I stated that no case of this compound character had, so far as I knew, occurred, or been recorded, but that on general medical principles, if, after taking poison, a person underwent strangulation, there was no reason, *quoad* the poison, why the usual appearances of strangulation should not be found in the heart and lungs. The poison being in the body, would not prevent the appearances which attend a sudden form of violent death; and lthough a contracted and empty state of the heart may be found in numerous ases besides death from strychnia, it is reasonable to infer that if the action of he poison had proceeded so far as to cause the emptiness and contraction of he organ, it had gone far enough to cause death, thus rendering it unnecessary o resort to any other hypothesis.

From all the facts of this case, it is in the highest degree probable that eceased took a portion of the powder containing strychnia on Tuesday vening, November 3rd, and that she died from its effects in the course of the ight; that when her body was found, she had been dead more than two days; hat the prisoner aided and abetted her in the act of self-murder; that he was ognizant of her death, and was for at least two days in the room with her ead body, without giving any alarm or calling for assistance; that he may or ay not have taken part of the powder, but that in accordance with their utually-expressed intentions, he had attempted to destroy himself by inflict- g a serious wound in his own throat. The wound was not of that slight ature which is observed in wounds self-inflicted for the purpose of concealing masking crime. He had lost much blood, and was depressed and faint hen found.

No suggestion was made in the course of the proceedings that deceased had ied from natural causes; yet as the head was not examined, owing to its ighly putrescent condition, it is obvious that those natural causes of sudden eath which operate by the brain, had not been excluded in this instance. ounsel for the defence might have suggested that a fatal attack of apoplexy ould have accounted for death as well as for the congestion of the head and eck, and the consequent blackness of these parts owing to putrefaction setting rapidly.

These two cases will serve to show that the changes produced by putrefaction a dead body, may often involve questions of life and death, and that they quire more attention from the medical profession than they have hitherto ceived. In alleged child-murder, it has been generally considered that highly putrefied state of the lungs prevents a correct medical opinion being rmed of their actual condition at birth; and there are few who would nture to infer from experiments on such lungs, that a child had breathed ter its birth. In reference to poisoning, when, in any suspected case, the ucous membrane of the stomach and bowels has undergone extensive anges from putrefaction, it would be unsafe to rely upon the appearances as idence of death from poison, although they might at first sight resemble ose produced by irritants. The same caution should be observed in forming opinion from the state of the skin when putrefaction is far advanced. The marks and discolourations which here take place, especially in parts of the body in which the venous trunks and capillaries are congested from any cause at the time of death, are liable to deceive the examiner when death is attributed to violence, and he is searching for proofs of this. In another place (page 46), I have quoted several cases of this description, and in one, according to the statement of Dr. Christison, a man appears to have been wrongly convicted of murder by strangulation chiefly because a broad blue mark was found in the front of the neck of the deceased. This was attributed to violence. There seems, however, to have been little doubt that it was due to post-mortem changes in the body.

Putrefaction, unless advanced to the last stage, cannot entirely destroy marks of violence when attended by physical injury to parts, such as abrasions or lacerations of the skin, laceration or crushing of the muscles with fracture of the trachea or larynx, protrusion of the tongue, accompanied by marks of indentation or laceration by the teeth. In such cases, a safe medical opinion may be formed in spite of the decomposed state of parts; but it is otherwise with superficial marks unattended with mechanical injury. These are precisely the appearances which occasion mistakes, as they may be really due to post-mortem changes, and not to violence. It is quite true that life may be destroyed by a slight degree of mechanical pressure, and the injury thus occasioned may be masked or obliterated by putrefaction. There is, however, this conclusion to be drawn: it is far better that a few cases of real homicidal violence should thus escape recognition, than that we should incur the serious risk of involving an innocent person in a charge which on conviction would necessarily lead to capital punishment. Murder by strangulation is murder in its worst and most aggravated form. The act itself implies malice and deliberate design. If the body is not decomposed, we may act safely: if decomposition has advanced to a great degree, whether generally or locally, it would be unsafe to base an opinion on superficial discolourations.

PUTREFACTION IN WATER.—The process here takes place more slowly than in the atmosphere, owing to the low temperature, and the free access of air being cut off. The skin covering the palms of the hands and the soles of the feet is found thickened, white, and sodden from imbibition, when the body has remained several days in water. Owing to this cause, ecchymoses resulting from violence during life, are not always apparent in a body recently removed from water; it is only when the skin has lost the greater part of the water by evaporation, that ecchymoses and other marks of violence begin to show themselves. The influence of air upon the skin of a body, which has been for some days submerged, is chiefly seen, after its removal from water, in the face and chest. In a few hours, if the temperature of the atmosphere be moderately high, the face will commonly be found bloated, and either livid or black. The features are so distorted, that they cannot be recognized by those who knew the person during life. The change chiefly consists in the skin becoming first of a livid brown colour, and afterwards passing to a deep green. According to Briand, when putrefaction takes place in bodies which have been lying in water, the discolouration of the skin is first seen in the face and lower part of the neck. It then spreads successively over the shoulders, chest, and legs. In bodies exposed to air, the discolouration is first seen in the abdomen, and thence spreads to the chest, neck, face, and upper and lower limbs. These discolourations are chiefly apparent in those parts which are freely exposed to the atmosphere. They are not commonly found on surfaces which have been in close contact, as in the armpits and upper and lower limbs, where the former have been closely applied to the sides of the trunk, and the latter have remained in close proximity to each other. For the same reason the discolourations are not commonly met with at the back of the body, or on those parts which have been closely wrapped in clothes.

Gaseous putrefaction takes place in bodies immersed in water, as well as in those which are exposed to air. The abdomen, chest, and cellular membrane beneath the skin are thereby distended: the body acquires buoyancy and rises to the surface. It requires but a very slight expansion of the cavity of the abdomen for this effect to follow, since the human body is only slightly heavier than its bulk of water. The position in which a dead human body floats, is commonly with the abdomen or back on the surface, and the head with the upper and lower extremities depending. The bodies of females, it is said, are more commonly found floating with the abdomen upwards. The period of time required for a body to rise to the surface, from gaseous putrefaction, must depend on many circumstances. It is stated to happen usually from the third to the fifth day after submersion. The gases may be then liberated and the body sink; they may be again generated and it will rise. The facts connected with the buoyancy of the dead body became of great importance in the trial of *Spencer Cowper* (1699), for the alleged murder of a female. (See DROWNING.) If the dead body has been submerged for some weeks or months, or has remained long exposed before inspection, the skin will be found of a deep blue, black, or green colour, the muscles soft and discoloured, or the fatty parts may have undergone a transformation into adipocere (p. 65). Ultimately the soft parts will be washed from the bones and the skeleton separated.

The changes from putrefaction, even when comparatively slight, may, as Casper justly remarks, seriously affect the value of medical evidence. The blood becomes decomposed, acquires a darker colour, and produces congestions in the brain, lungs, right side of the heart, and other parts of the body, o as to render it difficult to form a conclusion on death from apoplexy or sphyxia. ('Gerichtliche Leichen-Oeffnungen,' vol. 1, p. 89.)

The special researches on drowning made by Casper and Kanzler show that putrefaction of the bodies of the drowned, generally commences at the upper part and extends downwards. Thus, after a few days, while the lower part f the body may be in a tolerably fresh condition, the face, head, neck, and upper part of the chest may present a reddish colour passing into patches of a blueish-green, first seen on the temples, ears, and nape of the neck, thence preading to the face, and afterwards to the throat and chest. These changes may be observed in summer, when a body has remained in water from eight o twelve days, and in winter for a still later period. The head of a drowned erson is sometimes much discoloured from putrefaction, when the rest of he body is in its ordinary condition. Casper considers that this inverted rder of the putrefactive process may be taken as a strong indication of eath from drowning ('Ger. Leich.-Oeff.' vol. 2, p. 103); but while it may be dmitted that attention should be given to this circumstance, it yet remains to e proved whether a dead body thrown into water (when death has taken lace from asphyxia by suffocation or strangulation) would not undergo ecomposition in a precisely similar manner. It is worthy of remark that e uterus resists decomposition more than other internal organs. In a case which the body of a female, who had been missing nine months, was und and examined, although all the other organs were completely decomsed, the uterus was of a reddish colour,—firm in structure, and its parts ere recognizable, so that Casper, who conducted the inspection, was able to irm that the female was not pregnant at the time of her death. ('Ger. ich.-Oeff.' vol. 1, p. 93.)

An attempt has been recently made by the aid of baths of chlorine, salt, and drochloric acid, as well as by injections of chlorine, chloride of zinc, and sesquichloride of iron, to restore the features of a drowned person, so as to enable persons to speak to the question of identity. In the case referred to, the body had been an unknown time in water. It was deeply discoloured: the face was black; the lips, cheeks, and eyelids were greatly distended; and the nose scarcely visible. The effect of this chemical treatment, it is stated, was to diminish the tumefaction produced by gases, and to bring the face to a light clay colour. ('Lancet,' May 16, 1863, p. 551.) The intention of the operator (Dr. Richardson) was to restore the expression which the features had during life, that the witnesses who had seen a man charged with murder, and then missing, might be able to say whether the features were those of the missing man or not. They could not, however, recognize, in the restored features, any person whom they had ever seen before. The chlorine appears to have produced a slight bleaching action, but whether the process was efficacious or not, in the restoration of identity, must be a matter of conjecture. This could be determined only by the testimony of persons who had really known the deceased and had frequently seen him during life. After such changes produced by putrefaction in the drowned as are here described, it would be hopeless to attempt to restore the expression of the features of the living man. It is one thing to arrest or prevent putrefaction by these agents, but another to suppose that these chemical changes can be reversed, and the corpse put in the position of a body recently drowned. It is highly probable that the most intimate friend of the deceased would have failed to recognize the body under such circumstances.

Determination of the Period of Death in the Drowned.—Some attempts have been made to generalize on the phenomena of putrefaction in water, in order to enable us to say for how long a period a body may have been immersed. No satisfactory data, however, have been obtained to guide us in this enquiry. The changes which take place, are modified in their degree and the rapidity of their progress by numerous and often inappreciable causes. M. Devergie believes that he has obtained a certain series of characters whereby he can determine with sufficient precision, the length of time which a dead body may have been in the water, supposing the drowning to have occurred during the winter season. Thus according to him, in bodies immersed *from three to five days* we shall find: cadaveric rigidity; coldness of the surface; no contraction of the muscles under the galvanic stimulus; and a white or sodden appearance of the skin of the hands. From *four to eight days*—Pliancy of all parts of the body; no muscular contractions under the galvanic stimulus; natural colour of the skin; cuticle of the palms of the hands very white. From *eight to twelve days*—The whole of the body flaccid; the cuticle of the back of the hands beginning to whiten; the skin of the face softened and pallid, differing from the skin of other parts of the body. About *fifteen* days—The face somewhat bloated and covered with red patches; a greenish tint in the middle of the sternum; the cuticle of the hands and feet perfectly white, and becoming raised in folds. About *a month*—Face of a reddish-brown colour; eyelids and lips green; a reddish-brown patch surrounded by a green border on the fore part of the chest; the cuticle of the hands and feet white, thickened, and corrugated. About *two months*—Face brownish-coloured and swollen; the hair becoming loose; the cuticle of the hands and feet in great part detached; the nails still adherent. *Two months and a half*—Cuticle and nails of the fingers detached; that of the feet the same, but the nails still adherent. In the female there is a reddish colour of the subcutaneous cellular tissue in the cervical region, as well as of that which surrounds the windpipe and the organs contained in the chest; partial saponification of the cheeks and chin, superficial in the breasts, groins, and fore part of the thighs. *Three months and a half*—Destruction of part of the scalp, eyelids, and nose; partial saponification of the face, of the upper part of the neck, and groins; destruction of the integuments in different parts of the body; cuticle of the hands and feet as well as the nails entirely detached. *Four months and a half*—Almost complete saponification of the fatty parts of the face, neck, groins, and fore part of the thighs; the appearance of a calcareous incrustation or deposit on the thighs; incipient saponification of the fore part of the brain; opalescent condition of nearly the whole of the integuments; destruction and removal of the hairy scalp; the bones of the skull laid bare and beginning to become brittle. There are no data to give even approximative opinions for a longer period than this: and it is admitted that even these imperfect data are not available for determining the period of death in subjects drowned during spring and summer.

There is a common belief that the dead human body is soon destroyed by submersion in water; but this is not borne out by experience. In those who are drowned during winter, and whose bodies remain long below the surface, or are covered with mud so as to prevent a free access of air, decomposition takes place slowly. Mr. Eager of Guildford communicated to me a case, in which a man, æt. 70, was missing from January 6 to February 4, 1864. His body was found in a river, and there was reason to believe that he fell in and was drowned on the day he was last seen. The head, neck, and a portion of the chest, where unprotected by clothing, were thickly covered with mud. When this was removed, the features were perfectly recognizable, and although twenty-eight days had elapsed identification was easy. The only changes observed were as follows: the cuticle peeled away from he cutis when slight friction or pressure was made over those parts which had been covered with mud. The face and neck were somewhat darkened in colour, and the front part of the chest was marked with slight lines of lividity. There was no tumefaction whatever over any part of the body. The thickened skin of the hands and feet was corrugated and whitened by ong-continued maceration, but remained firmly adherent to the tissues beneath it. With these exceptions the body presented no appreciable alteration f appearance, nor any departure from that which would be observed n a recently dead body.

In 1857 I was consulted in the following case. Some parts of the body of n infant were found floating on the surface of water in a pit. There was the kull with the sodden skin upon it, but the brain, eyes, and ears had dis-ppeared. The upper part of the chest and one arm were found. The soft arts appeared to enclose the bones, which were quite loose and discoloured, ut saturated with water. Some of the articular cartilages were still attached, though very much softened and easily separated. There were the remains f a woollen cloth in which the body was probably wrapped. It had been ept at the bottom of the water for some time by a heavy stone found there, hich was no doubt attached to the body. Upon these facts the questions bmitted to me, in reference to a woman delivered of a child eighteen onths previously, and suspected of murder, were, whether it was possible at a human body could remain so long a time as eighteen months in water, thout being totally destroyed. Further, whether the action of water ould not increase the bulk of the body, so as to make a new-born child pear some weeks old. The answers to these questions were:—1st. That a ad human body submerged is not necessarily destroyed in eighteen months; d in reference to this case, it appears probable from the description that the dy had been immersed for a longer period. 2. That in the early stages of seous putrefaction, the body may appear larger from general distension; t this stage had been long passed in reference to these remains. Although s was probably, a case of infanticide, there were no data to determine ether the child had been placed in the water living or dead.

Mr. Harris, of Redruth, met with a remarkable instance of the effects of water on the human body after submersion for the long period of twenty-six years. In 1828, a healthy muscular man æt. 24, fell into the shaft of a mine, fifty fathoms deep, of which thirty fathoms consisted of water. The efforts to recover the body were unsuccessful. The shaft was closed over, and so it remained until April 1854, when the working of the mine was resumed. The skeleton of the missing miner, with portions of the clothes which he wore, was discovered in one of the levels, in which there was water. The remains, as well as the clothes, buttons, and boots found on the skeleton, were identified by his brother. Mr. Harris found that all the soft parts, with the exception of a small piece of fatty substance, were destroyed, but the bones were firm and well preserved. There was no muscle, tendon, ligament, or even cartilage about any of them. They were all detached from the joints. They were of a dirty brownish or almost black colour. The skull was full of a brown soft substance, which was without smell. There was nothing in the water calculated either to destroy the soft parts or preserve the bones. The water, as it ran from an adit leading from the shaft into which deceased had fallen, had been long used by the inhabitants for domestic purposes. It was habitually drunk by persons in the neighbourhood, and was considered to be very pure!

It is not often that any very precise opinion is required of a medical witness respecting the probable period at which death has taken place from drowning. A question has, however, arisen respecting the time required for the production of *adipocere* in the drowned, and on this has depended an important question relative to the presumption of survivorship. The property of a gentleman who had committed suicide by drowning, was seized under a commission, and an action was brought to recover it at the Warwick Lent Assizes, 1805, on the ground that the insolvent was dead at the time the commission was issued. The following is an outline of the case:—

The deceased, who was in a state of insolvency, left his home on the 3rd of November; and on the 12th of December following, *i. e.* five weeks and four days after his departure, his body was found floating in a river near the place where he resided. A commission of bankruptcy had been taken out against him a few days after he was first missed, and before it was known that he had destroyed himself. It became therefore important to determine whether he had drowned himself (for there was no doubt of his having committed suicide) *before* or *after* the date of issuing this commission. If it could be shown that he was already drowned when it was issued, the commission would be void in law, and his property could not be seized under it. The litigation then turned upon the question, whether he had drowned himself on the day of leaving his house, or at any time afterwards. The body was found floating with the head and feet submerged. On being taken out, the face was covered with a muddy slime. The body was discovered on a Wednesday, and a coroner's inquest was held on the following Saturday. On the Friday, the day before the inquest, three medical men examined the body with a view to ascertain whether any change had taken place in it, which could justify an opinion as to the time during which it had been lying in the water. The muscles of the buttocks were found to be converted into a fatty substance, very much resembling suet (adipocere). The face was completely disfigured by putrefaction. The hair of the head separated from the scalp by a slight pull. The other parts of the body were firm and white, without any putrefactive appearance. The clothes externally seemed unchanged in any way; but the shirt and neckcloth were so rotten as to be torn by the slightest force.

Mr. Dickenson, a medical witness for the plaintiffs, *i. e.* the relatives of deceased, stated it as his opinion that the body could not have been less than *six weeks* submersed. Three or four weeks would not have sufficed to produce the appearances met with. He thought the adipocerous state of the body could not have been brought about in *less* than six weeks. In cross-examination he admitted that he had met with an instance in which a body taken from the Severn had a spermaceti appearance within a shorter time, although the change had not advanced so far as in this instance. Dr. Bree said that the parts of the thigh and abdomen were changed into a soapy fat or adipocere. He supposed the body must have been under water for more than six weeks; he therefore thought the deceased must have been in the water during the whole time that he was absent. If it had been exposed to the air it would not have presented the appearances met with. In cross-examination he admitted he had said that the body was in such a state, that it would be impossible to express an opinion. Dr. Gibbes stated that he had been for many years engaged in experiments on the production of adipocere, and had published the results of these in the 'Philosophical Transactions.' He had been able to procure a small quantity of adipocere from muscle by maceration in water for *a month*; but in general, it required a much longer period for this transformation to take place. Upon this scientific evidence, the jury were of opinion, that the deceased was not alive at the time the commission was taken out, but that he had been dead for the whole period of his absence; and the bankruptcy was accordingly superseded.

In medicine as in law, there are always two sides to a question; and accordingly there appeared just as many medical witnesses for the defendants, i. *e.* the creditors, as for the plaintiffs. The case, *primâ facie*, as we have seen, was in favour of the plaintiffs. The state of the body supported this view, although it might have been contended for the defendants that a few days more or less would have made no difference in the results, and that deceased might therefore have been alive when the bankruptcy was declared. The verdict of the jury was physiologically well founded. The general period required for the production of adipocere in drowned bodies, is stated by most observers to vary from three or four months to a year. Its occurrence in a body to any extent, within five weeks and four days, must be egarded as an exception to an extensive series of observations. The witnesses or the plaintiff were then justified in assigning the longest possible period, hat the circumstantial evidence would admit, for its production in this nstance. The facts of this case show that adipocere may be produced in the ody of a drowned subject within a period of six weeks. The defendants wished to make it appear that the adipocerous transformation might take place with much greater rapidity, but there were no facts to render this view probable, while there were many facts in support of the contrary opinion. One instance of its early production is related by Dr. Harlan, of Philadelphia. He had occasion to macerate the cranium of a fat negro in the summer of 824; it was placed in a barrel of water, and kept closely covered over. bout six weeks afterwards he observed the head floating on the surface, and ather inclined on one side. The portion of the head which floated above he level of the water was tumefied, and on cutting into it, the whole substance, down to the bone, was found converted into adipocere: but that portion the head and face which was immersed in water, was in a putrescent state. It may be as well to compare the facts of this case with the rules laid down y M. Devergie, for determining the period during which bodies have remained water. The deceased was an adult, and the drowning took place during he winter season:—it is therefore a favourable case for testing the value of hese rules. M. Devergie fixes the earliest period for the production of dipocere at about two months and a half: he then speaks of its commencing the cheeks, chin, breast, groin, and fore part of the thighs. Here, however, less than six weeks, the adipocerous change had taken place completely in the muscles of the lower part of the abdomen and of the buttocks. M. Devergie states that the hair of the scalp becomes loose in about two months: here it separated with the slightest pull in six weeks. The data furnished by this medical jurist, would therefore tend to assign a much longer period of submersion than six weeks, to a body presenting the characters observed in this case. It is scarcely necessary to remark that rules of this kind can, however, only be regarded as remote approximations to the truth.

Still, more recently, another case occurred, in which the late Mr. Callaway informed me that he was required to give evidence respecting the probable period at which drowning had taken place, from the partial conversion of a body into adipocere.

When a dead body is immersed in a liquid of a preservative nature, as in the water of a peat bog, the changes which take place are of a peculiar kind, and they render it difficult to arrive at even an approximate conclusion respecting the period of death. In July 1858, Dr. Barry, of Kanturk, Ireland, consulted me in reference to the following case. A male human skeleton was found near the surface of a peat-moss or bog. All the bones were detached, and were of a deep chocolate colour. The right femur had been accidentally fractured obliquely by an instrument used by the peasantry in cutting turf. The skin and muscles were closely adherent to it. They were free from any unpleasant odour, and were completely tanned. The bones were destitute of phosphate of lime, and in consequence were as flexible as cartilage. Dr. Barry calculated by a comparative measurement of the thigh bone, that the stature was five feet seven inches. The sex was determined as usual, by the roughness of the bones, and the size and shape of the pelvis. There were no means of determining the cause of death. The skull had not been fractured. It was supposed that the person had been shot and the body deposited in the bog ten years previously, but Dr. Barry was of opinion that it might have been lying there fifty years. The removal of the phosphate of lime was a remarkable fact; it probably depended on the action of some acid in the water. Tannic acid was, no doubt, the agent by which the soft parts were preserved.

CHAPTER 6.

IDENTITY OF MUTILATED REMAINS—CASES—EXHUMATION OF SKELETONS—HUMAN AND ANIMAL BONES — DETERMINATION OF SEX, AGE, AND PERSONAL PECULIARITIES—DETERMINATION OF AGE BY THE TEETH — QUESTIONS OF PERSONAL IDENTITY—EVIDENCE FROM FRACTURES, DISEASE, AND DEFORMITY.

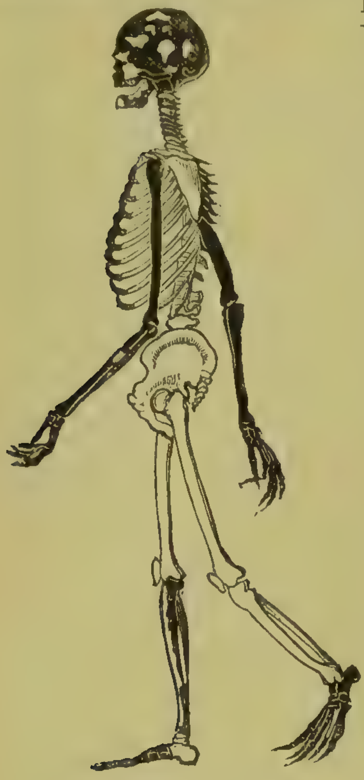
Identity of mutilated Bodies.—A DEAD body partially putrefied, may be found mutilated, and parts of it may be discovered in localities distant from each other. There is less difficulty here in making out identity, than where only bones are discovered; for it is by no means easy to say whether certain bones belonged to the same skeleton or not. So long as the soft parts are attached to them, there will be no difficulty in forming an opinion. Those who commit murder, and thus dispose of a body, believe that identity must be entirely destroyed, if they only deposit the parts in remote places. In this respect, however, they are generally deceived: for satisfactory medical evidence may still be forthcoming. In the case of the woman *Brown*, murdered by *Greenacre* in 1837, the head, trunk, and limbs were scattered in widely distant parts of London. The limbs were not found until six weeks after the trunk, and then at a considerable distance, and under very different circumstances. In the examination of the trunk, it was observed that the fifth cervical vertebra had been sawn through, leaving only about the tenth of an inch of that bone. When the head was found it was observed that the fifth cervical vertebra had also been sawn through, leaving only the posterior spinous process. On comparing the head with the trunk they fitted exactly, even to the continuation of a superficial cut on the skin. On afterwards comparing the trunk with the legs, it was ascertained that the cut surfaces exactly corresponded. The thigh-bones remaining attached to the trunk, had been sawn through about an inch below the trochanters, to about one half of their thickness, and then broken off. When the limbs were discovered six weeks afterwards, the portions of thigh bones found, exactly corresponded in the marks produced by the saw and in the portions broken. Not only were the parts of the body thus proved to belong to one and the same female, but the individual was further identified by the peculiarity of the absence of a uterus.

In a case of infanticide, which was the subject of a trial in 1839, the arm of a child was found concealed in a dust-hole of the house, while at about the same period, the body without an arm, and the head of a child, were found in a ditch at some distance from the house where the accused person was living. The identity was, however, distinctly made out by the fact, that the arm and scapula attached to it, fitted exactly to the trunk, and that the incisions through the muscles and vessels completely corresponded.

On the occasion of a murder perpetrated at Brighton some years ago, the head and subsequently the body of a female were found in different and distant places. They were clearly identified as belonging to the same individual: first, from the fact that there were four cervical vertebræ attached to the trunk and three to the head; and secondly, from the divided vessels and cartilaginous rings of the trachea exactly corresponding. The importance attached to this kind of anatomical evidence, shows that when a portion of a dead body is found, the whole of the parts which form the boundary of the section, should be attentively observed and accurately described.

The case of Dr. Parkman for the murder of whom *Professor Webster* was tried and convicted at Boston, United States, in March 1850, presents a remarkable instance of the value of scientific evidence, in establishing the identity of a mutilated body. It also proves that even all the refinements of science will fail in the attempt so to dispose of a dead body in a case of murder, as to prevent its identification. On November 23, 1849, the deceased, Dr. Parkman, was traced to the laboratory of the prisoner, and from that date he was missing. A week after his disappearance, there were found concealed, in the vault of a privy belonging to the prisoner's laboratory, a pelvis (the hip-bones), the right thigh (from the hip to the knee), the left leg (from the knee to the ankle);—and with them certain towels bearing the initials of the prisoner, and being such as were used by him. Among some cinders and slag, connected with a furnace, were found portions of bones, apparently of the cranium, fragments of vertebræ, blocks of artificial teeth, and some gold which had been melted. On the day following, in a remote corner of the laboratory, there was found a tea-chest containing, imbedded in a quantity of tan and covered with minerals, the entire trunk of a human body, with the left thigh from the hip to the knee. When the parts were placed in apposition with the portions previously found, they corresponded, so that they were obviously parts of the same body. This observation also applied to the remains of bones (cranium and vertebræ) found in the slag of the furnace. There was no duplicate portion. All the fragments fitted so as to form part of the same human skeleton. The portions thus found resembled in every particular the body of Dr. Parkman, and in no single particular were they dissimilar from the body of the deceased. There were missing from these remains, when they were placed in apposition, the head, the arms with the hands, both feet, and the right leg from the knee to the ankle.

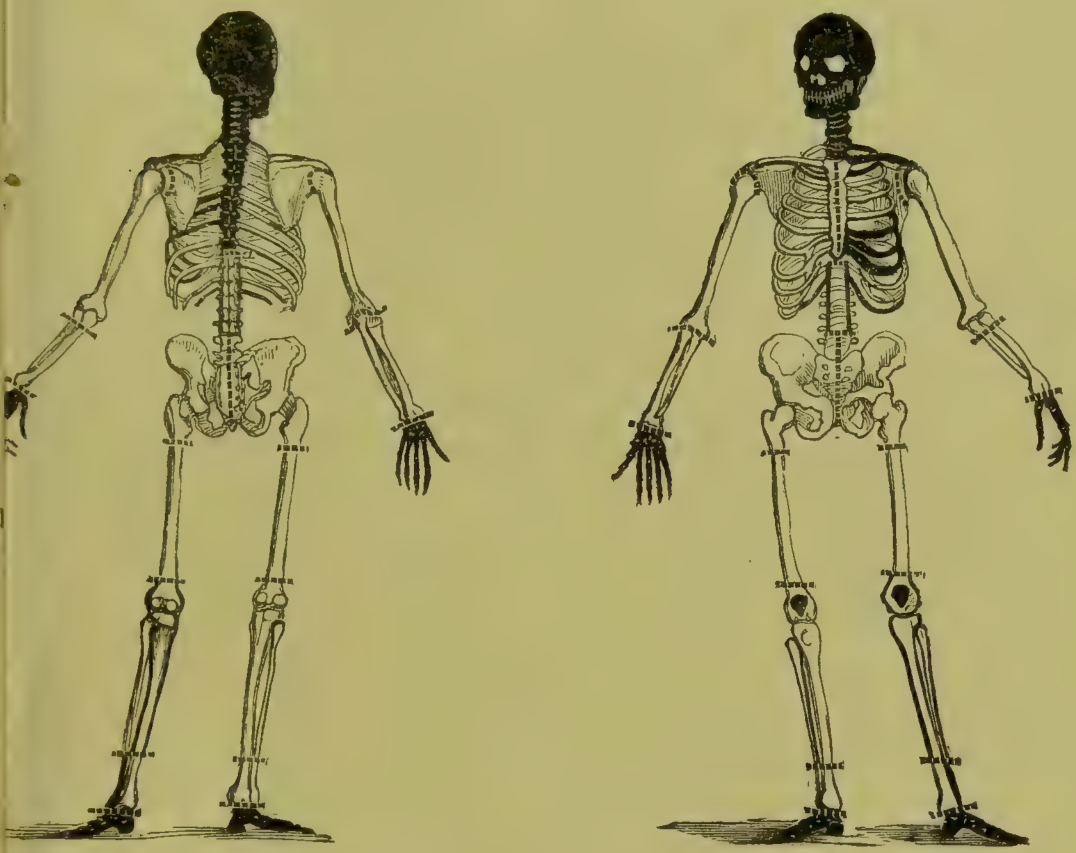
The parts found (which are light in the engraving) were accurately examined by several medical gentlemen. They deposed that they were human remains, parts of one and the same human body of the male sex; that they had not undergone dissection for anatomical purposes, and had not been submitted to any process of preservation. Further, that they had been cut and hacked in different directions without any reference to their anatomical relations, and evidently by a person only partially acquainted with the structure of the body. The chest was still covered with the muscles and skin. It was noticed, that under the left nipple, between the sixth and seventh ribs, there was an opening which penetrated into the cavity. The opening was slightly ragged, and about one and a half inches in length.


Dr. Parkman's remains restored.
The missing parts are black.

It seems that Dr. Parkman was sixty years of age, and his stature was five feet eleven inches. The portions of the body thus restored, were those of a person between fifty and sixty years of age; and with respect to stature, the portions found, extending from the seventh cervical vertebra to the outer ankle (malleolus) measured 57½ inches. The distance from the sole of the foot to the outer malleolus, measured in another subject of the same age, was 3 inches; and the distance from the top of the head to the base of the sixth cervical vertebra was 10 inches. Adding these measurements to the missing portions, the total length of the body found would be 5 feet 10½ inches, being within half an inch of the stature of Dr. Parkman. There were marks of identity about the teeth and jaws which left no doubt that the remains were those of the missing gentleman (see page 106). An attempt had been made to destroy the skin and flesh of the chest, by the use of a strong solution of potash, but this had failed. The defence of the prisoner rested upon the facts that the charge was based entirely on circumstantial evidence, that the identity of the remains had not been satisfactorily made out, and that no cause of death had been proved. The jury, however, returned a verdict of guilty, and the prisoner was subsequently executed (see 'Report of the Trial of Professor Webster' by Dr. Stone, Boston, 1850).

A singular case involving somewhat similar questions occurred in London in October 1857. I allude to the remains of a human being, found in a bag on one of the buttresses of Waterloo Bridge. It appeared that they had been accidentally deposited there the night previously—the intention of the person who carried them being, no doubt, to lower them into the river, but by accident they lodged on one of the buttresses of the bridge. A number of articles of clothing were in the bag with the remains. By an order from the Home Office these remains were submitted to the examination of Mr. Painter, the Divisional Surgeon of Police, and myself.

We found them to consist of parts of a human body, and obviously of the same body, as, when allowance was made for the missing portions, they admitted of an accurate adjustment to each other. There were twenty-three portions of the body discovered, consisting chiefly of bones with flesh adhering to them. The flesh had been roughly cut from the bones, apparently with a view to remove as much of it as possible, and to completely destroy the identity of the body. The parts had been cut and sawn into small lengths, probably to reduce their bulk and to allow them to be packed within a small space. The trunk, including part of the chest and spine, had been cut into eight pieces ; the upper limbs had been cut or sawn into six, and the lower limbs into nine pieces. The hip and elbow joints were in a strongly flexed condition. The missing portions, which are marked black n the engravings, were the head, with the greater part of the spine, namely



Waterloo Bridge remains restored. Front and back view of the Skeleton. Dotted lines showing where the bones were cut or sawn. Missing parts black.

urteen out of twenty-four vertebræ (seven cervical and seven upper dorsal), e hands, the feet, and some portions of the left side of the chest. It will be bserved that these were also the parts which were missing in the case of r. Parkman. In fact, a murderer intending to destroy personal identity, ould in general most effectually succeed in his object by removing the head, et, and hands. The whole of the viscera of the chest and abdomen had so been removed. The twenty-three fragments found weighed only ghteen pounds. This is about one-eighth part of the average weight of the ult body. The questions which required solution in this case were the lowing :—1. The sex, age, and stature of the deceased ; 2. The presence any physiological or pathological peculiarities in reference to personal entity ; 3. The presence of any wounds or marks of violence, with reference the probable cause of death ; 4. The general condition of the remains, th a view to determine whether they were parts of a dissected body, and hether they had undergone any chemical process for the purpose of preser- tion ; 5. The length of the period which had probably elapsed since the death the deceased. The details of this examination will be found elsewhere Med. Gaz.,' Oct. 31, 1857, p. 445). There was no difficulty in determining e sex of the deceased, as a portion of the sexual organs, which had been tilated (not dissected), still remained attached to the pelvis. The long bones re in their full state of development. The stature was determined by taking e length of the portions found, and adding a certain number of inches for the missing skull, cervical vertebræ, and feet. The bones had been sawn through near the joints with a fine bone saw, such as is used by bone boilers. On the left side of the chest, between the third and fourth ribs, there was a stab which had penetrated the cavity, and which, if inflicted on a living person, would have been in a direction to enter the heart. The edges of this wound were everted and wide apart, and the muscles around were infiltrated with blood. It had those characteristics which are observed in wounds inflicted on a living body. In Dr. Parkman's case there was a similar wound penetrating the chest on the left side between the sixth and seventh ribs (page 88). No portion of these remains had the appearance of having undergone dissection, or any preparation or use for anatomical purposes. There was no injection of blood-vessels; the muscles, vessels, and nerves had been cut through, or rather hacked in all directions, without any reference to relative position. The spinal marrow had been violently torn out of the vertebral canal, and was left hanging by its sheath to the vertebræ. The joints had been sawn through, evidently with great trouble, at points where a scalpel, even in the hands of a young anatomist, would have speedily effected the separation of the limbs. Further, no preservative of animal matter had been employed. There was no trace of arsenic, corrosive sublimate, nitre, salts of alumina or chloride of zinc in the soft parts. Portions of the muscular fibre were brown and sodden; they presented the appearance of having been boiled in water and soaked in a solution of common salt, which was separated from them by crystallization. Portions of the skin, as well as the ligaments of the joints, had a similar appearance, *i.e.* of having been submitted to the action of boiling water. From the condition of the soft parts and joints, it appeared probable that the body had been cut up and exposed to a boiling temperature, while the members were in a state of cadaveric rigidity. We considered that the boiling and the salting of the remains had been resorted to in order to prevent any offensive smell as a result of putrefaction, which might have led to their discovery. The interior of the right hip-joint, and the deep-seated portions of flesh around the joint, had escaped the action of salt and water; and from the condition of these parts, as well as other circumstances, we formed a conclusion respecting the probable period at which this person had died. The conclusions from the whole of the investigation were as follows:—

1. That the remains were those of a person of the male sex, of adult age, and of at least 5 feet 9 inches in stature; 2. That the parts found, presented no physiological or pathological peculiarities by which they could be identified as belonging to any particular individual. The only fact observable under this head was, that the portions of skin remaining, were thickly covered with dark hairs and that the deceased was probably a dark hairy man; 3. That the remains presented no appearance of disease or of violent injury inflicted during life, with the exception of a stab in the space between the third and fourth ribs on the left side of the chest. This stab was in a situation to penetrate the heart and to cause death. It had the characters of a stab inflicted on a person, either living or only recently dead; 4. That these remains had not been dissected or used for the purposes of anatomy. All those parts of the human body which are useful to an anatomist, had been roughly severed and destroyed by a person, or persons, quite ignorant of their anatomical relations. They had been probably cut and sawn before the rigidity of death had ceased, *i.e.* within from eighteen to twenty-four hours after death; and in this state, had been partially boiled and subsequently salted (placed in brine). The body of deceased had not been laid out or attended to like that of a person dying from natural causes, whose body might be lawfully used for anatomical purposes; 5. That the person of whose body these

remains were a part, may have been dead for three or four weeks prior to the date at which they were examined, namely, on October 21, 1857.

The articles of dress found with the remains in the bag, were those of a man and a foreigner. They were much torn: some presented the appearance of stabs and cuts, while all were more or less stained with blood, some of the stains presenting coagula. A stab through the double-collar of an over-coat must have been inflicted with great force, as it was found to extend through corresponding parts of the under-coat and waistcoat. All these articles of dress had stains of blood on the inside, and chiefly on the left side of the body, in the parts corresponding to the stab on the left side of the chest. The utting and tearing of the dress may have arisen from the removal of the clothes while the body was in a state of rigidity in a constrained attitude. The state of the clothes was consistent with their having been worn by the deceased when he was subjected to violence which led to his death.

From enquiries made by the police, there was reason to believe that the emains were those of a Swedish sailor from a vessel then in the river. It is believed that he met with his death by stabbing, and that after a short oncealment, his body, cut up and mangled in the manner described, was isposed of by throwing it into the river. The head and other missing parts had probably been thus got rid of; and it was only by the accident of the bag lodging on a buttress of the bridge, instead of falling into the river, that these remains were found. As the deceased was most probably a foreigner, whose name was not known, and of whose personal appearance no description ould be given, no clue has hitherto been found to the perpetrators of this murder. In this respect it resembles several other murders of recent date, in which the bodies have been discovered entire.

In reference to these cases of mutilation, there is one point which requires a rief notice. When parts of dead bodies are found, a credulous section of the ublic commonly adopt the hypothesis, that some medical student has resorted o this method of disposing of parts of a dissected subject, in order to alarm he neighbourhood. Thus, in the case of Greenacre, there was a general dis-osition to refer the first portion of the mutilated remains which were iscovered to a wanton act of this kind. The erroneousness of this view was roved only by the subsequent discovery of the corresponding parts of the ead body and the detection of the murderer. So in reference to the ase of Dr. Parkman, the mutilated remains, were at first described as natomical preparations! Such an hypothesis is of course highly favourable the escape of criminals, and is eminently prejudicial to the course of justice. points out to the assassin an easy method of deceiving the public; and it ows that if he only mutilates a corpse by removing and destroying the head, nds, and feet, leaving the remainder of the body to be discovered accident-ly, he has a far better chance of escaping detection and punishment than by tempting to conceal the entire murdered body. The Waterloo Bridge case rmed no exception to the protection, thus unintentionally extended by blic opinion to a foul act of murder. Any one acquainted with anatomy d the dissection of bodies, would at once perceive from the description, that portion of this body could have been used for such a purpose. Medical dents do not, as part of their anatomical pursuits, hack and mangle a dead dy so as to destroy muscles, vessels, nerves, and spinal-marrow; they have occasion to make away with all those parts by which a body may be ntified, or to boil and salt the remainder: they do not receive corpses for ssection with their clothes, nor is there any conceivable reason why, if y did, they should produce cuts and stabs and stains of blood on the thes with such accuracy as to correspond to the effects of wounds inflicted a living man! It was suggested that no murderer would have secreted the clothes with the remains. It is difficult to speculate on the proper course which should have been pursued by men, who are fresh from the perpetration of an atrocious crime, and who are anxious to conceal it, but this may be fairly said: the bag of clothes with the remains was lowered over the bridge with a view that it should fall into the water and be carried away by the tide: it was owing to mere accident that it was found in the situation described. The head and other parts had no doubt been already successfully disposed of by a similar proceeding.

The identity of the bodies of soldiers and sailors has been sometimes established by the existence of marks on the skin, such as anchors, stars, initials, &c., indelibly impressed in the structure by colouring matter.

It is not often that a question arises whether a portion of a body found is that of a human being or of an animal. In 1838 that which was at first supposed to be a human hand, was found in a dust-bin in the City. It was alleged that a murder had been perpetrated, and an enquiry took place at the Mansion House in reference to the supposed atrocious crime. Some doubts were raised whether the relic produced was really the hand of a human being. In order to have these doubts removed, it was sent to St. Thomas's Hospital for the inspection of Mr. Solly and other medical gentlemen, when it proved to be the fin or paddle of a turtle!

Exhumation of Skeletons.—It occasionally happens that medical investigations are required to be made so long after interment, that all the soft parts of the body are destroyed, and nothing but the entire skeleton or a few bones may be discovered. In either case numerous important questions may arise affecting identity as well as the mode of death. Indications of murder or violent death may be obtained long after the entire destruction of the soft parts. Briand relates the case of a female, whose body was disinterred in 1833, after eleven years' burial. It was believed and alleged that she had been murdered, and her body afterwards buried by her murderers. This was found completely reduced to a skeleton, but nevertheless the third, fourth, fifth, and sixth cervical vertebræ were still held together by a dark coloured mass derived from the decomposition of the fleshy parts of the neck; and this mass was still surrounded by several folds of a cord, which had been employed as the means of strangulation. Proof was thereby obtained of the mode in which the murder had been perpetrated. It was also possible to determine the length and colour of the hair, the state of the teeth, and the form and length of the bones. A ring was found on the bones of one finger which left no doubt whatever of the identity of the deceased.

In 1829, a man named *Guérin* was condemned at the assizes at Versailles for the murder of his brother. The murder had been perpetrated on the 21st August, 1825, and the body had been buried in the corner of a damp cellar. The exhumation of the remains took place three years after interment, and it was ascertained by inspection that the deceased had been destroyed by blows on the cranium with a bruising instrument of large surface, and the identity of the deceased was clearly made out by the disposition of the teeth, the malformation of the vertebral column, and the curved form of the bones of the legs. All these facts were deposed to by witnesses.

The case of *Eugene Aram*, although of old date, also furnishes an instance of the necessity for closely examining skeletons when it is suspected that the individuals have died from murderous violence. This man conspired with another to murder a person named Clarke. The deceased suddenly disappeared, in February 1745, and his absence could not be accounted for. In 1758, *i.e.* thirteen years after his disappearance, some bones were accidentally discovered in a cave near the town where he lived. Aram's accomplice was arrested on suspicion: and, losing his presence of mind, when charged with the murder, he denied that those were the bones, but mentioned the spot where the bones of Clarke were buried. A skeleton was there found, and the traces of a fracture and indentation of the temporal bone were plainly perceptible. The manner in which the murder was committed, was confessed by the accomplice, and the medical evidence corroborated this confession. Aram, who was a man of some ability, argued in his defence, that it was impossible to identify a skeleton after the lapse of thirteen years; that the fracture of the skull and the piece of bone beaten inwards proved nothing; that it might have lain long in the cave where it was found, which had been a hermitage, and therefore a likely place of sepulture; and that the appearance of violence to the skull, might have been produced in times of disorder, when, in searching for treasure, the graves and coffins of the dead were violated. He also positively denied the conclusions as to the sex of the skeleton; but this objection was entirely set aside by the medical evidence. In spite of the ingenuity of this defence, the facts were too strong against him, and he was convicted and executed.

Aram's defence throws some light upon the questions of doubt which are apt to arise when evidence is given from the examination of exhumed bones. Thus, for example, we find three points strongly urged, involving the consideration of the time required for the destruction of the skeleton and therefore of its identity; of the form, situation, and appearance of a fracture of a bone, so as to enable a medical witness to determine whether it be of recent or of old standing, and whether it was likely to have been caused by accident previously to or during the exhumation, or had arisen from the direct application of violence to the skull during life. Lastly, a clear determination of the sex may be required from an examination of the bones. This, of course, is material to identity, and therefore one of the first circumstances to which a medical witness should direct his attention.

Mr. Perfect has reported a case which shows the importance of attending o *sex* in exhumed skeletons. Two brothers lived together in a farm in the eighbourhood of London. The younger of the two was dissolute and regular in his habits, so that they lived very unhappily together. One inter's night, when the ground was covered with snow, the younger brother bsconded from the house by letting himself down from his chamber window; nd when he was missing the ensuing morning, his footsteps were clearly raced in the snow to a considerable distance, but there were no footsteps of ny other person. Time passed on, and nothing was ever afterwards heard of ıe missing brother. The elder brother left the farm, and it passed into the ands of a stranger. During the progress of some alterations in the grounds urrounding the house, a skeleton was dug up. It was immediately conectured that the one brother had murdered the other; an investigation was alled for, and an inquest was held. Mr. Perfect, who was not summoned a witness, requested permission to examine the bones. Having disposed em in their natural order, he found that they represented a person of short ature; and from the obliteration of the sutures of the skull, and the worn ate of the crowns of the teeth, he inferred that they must have belonged to aged person. On examining the bones of the pelvis, it was perceptible at they had belonged to a *female*. When this fact was communicated to e jury, the two medical men, who had given their opinions from a hasty amination, were sent for, and one of them immediately corroborated the atement that the skeleton had belonged to a female. The proceedings were course at an end, and a heavy suspicion, amounting to a charge of tricide, was thus removed from an innocent man. On further enquiry, was ascertained that the bones had been removed from an old gravel-pit, here gipsies had been accustomed to assemble, and occasionally bury eir dead.

From the examination of many reported cases in which medical evidence has been required on these occasions, I find that the circumstances to which enquiries have been especially directed are the following: —

1. Whether the bones are those of a human being, or of some animal. 2. If of a human being, whether they belonged to a male or a female. Having thus far established their identity as part of a human skeleton, some subordinate questions may arise respecting them. 3. The length of the period during which they have probably remained in the ground. 4. The probable age of the individual to whom they belonged. If the upper and lower jaws be found, we shall derive much assistance in solving this question by an examination of the teeth. 5. The probable stature of the individual when living. 6. The race to which he belonged: thus we must not confound the skeleton of the Caucasian with one of the negro variety: for, from the mixed nature of our population, even this may become a material question in relation to the guilt or innocence of an accused person. We are then bound to examine these bones for certain special characters, the observation of which may be necessary to throw a light upon the general evidence; while inattention to them or a misinterpretation of them at the time of examination, may lead to the defeat of justice, and to the censure of the medical witness. 7. It will be proper to determine whether solitary bones belong to the right or left side of the body, and whether they form parts of one, or of more than one skeleton. 8. Whether they have sustained any mechanical injury during life, *i. e.* whether at any antecedent period they have or have not been fractured; and if a fracture has existed, whether this has occurred during life or by accident during the exhumation: if during life, whether it be recent or of old standing. 9. The presence or absence of personal deformities, the presence or absence of supernumerary fingers or toes, of a curvature of the spine, of a curvature of the bones from mollities ossium, or of anchylosis of one or more joints. 10. Murderers sometimes attempt to make away with their victims by burning the bodies: it may be therefore proper to determine whether the bones have or have not undergone calcination. This especially applies to cases of infanticide. Sometimes but a very small portion of the fœtal skeleton can be procured for the formation of a medical opinion.

Other points of circumstantial evidence also demand attention—the position of the bones when discovered in the ground, whether lying at full length or grouped together confusedly. In all bodies which have undergone Christian burial, the skeleton is found lying at full length, with the head to the west and the feet to the east, and one skeleton may be found below another. By an attention to these points, the locality has been at once identified as the site of a burial-ground, where bones have been discovered during excavations for the foundation of new buildings. This inference is confirmed when the bones of persons of all ages and of both sexes, are found in or near the same spot. In ancient times, the body was consigned to a stone chest in a sitting posture, with the arms clasped about the knees. Thus, in these graves, the skeleton has been discovered with the thigh bones folded on the chest. It is not unusual to find human mixed with animal bones. I have procured from a deep grave in an old cemetery, the bones of a horse mixed with the bones of the male human skeleton. Occasionally, in ancient times, this animal was killed and buried with his deceased owner: and probably the disinterment of these bones, in old burial grounds, has given rise to the fables of giants. In one cemetery in the vicinity of London, the bones of the horse were frequently found, when the excavation was carried to a great depth. The bones of the ox have also been met with in graves mixed with human bones. I have in my possession the upper part of the thigh bone of an ox, which was dug out of a deep grave in a country hurchyard : it was forwarded to me as an unusually developed thigh bone of human being !

Identity is sometimes strikingly made out by the presence or absence of the eeth, by their form, position, worn appearance, and the number that may be leficient : and if absent, whether removed long before death. The examina-ion of the teeth often aids considerably in the determination of the age of a keleton. The discovery of certain articles of clothing, known to have belonged o a missing person, in association with the bones of a skeleton, will sometimes emove any doubts that may have arisen on the subject of identity. Metal uttons, brooches or rings, are imperishable, and should be sought for by sifting r washing the earth. In *Reg.* v. *Platts* (Derby Lent Assizes, 1847), prisoner vas charged with the murder of a man named Collis. The deceased had not een seen alive since December 7th, 1845. On August 28th, 1846, some men n cleaning out a cesspool in the neighbourhood, found some human bones with ertain articles of dress, which were supposed to be those of the missing nan. Besides the ribs, there were two thigh bones, and two leg bones. The esh readily came off the bones and fell into the soil. With these remains, here was the ordinary dress of a man, namely, coat, hat, trousers, and eckerchief, including two garters, one red and one white. These were still round the bones of the legs. A medical witness, Mr. Walker, stated that e had examined the bones, and found them to be those of a male human eing, from twenty-three to thirty years of age. All the bones were complete xcepting a few belonging to the neck, and three ribs. On examining the kull, he found a deep fracture in the region of the forehead five inches in xtent. There was another fracture over the left eyebrow, and a third across he base of the skull. These fractures, in his opinion, were inflicted on the ving body. The other bones, which appeared to have been separated by the ielding of the ligaments as a result of putrefaction, presented no marks of iolence. The injuries to the skull were produced by some cutting or sharp-dged instrument. They were sufficient to cause death, which might have ken place either immediately or after some time. The clothes were identified those worn by the deceased at the time of his disappearance, and the white d red garters found round the leg bones were identified by a woman who ade them, and presented them to the deceased.

The prisoner was connected with the act of murder by a chain of circum-ances. On December 7th, he was seen with a hammer in his hand quarrelling th the deceased. At a later period, he was seen with two other men pushing ceased, who appeared to be in a stupefied state, into his shop. On the night lowing he was seen with two other men carrying a heavy substance in a ck, in the direction of the cesspool, where the skeleton was afterwards found. e prisoner had made false statements respecting the transactions between mself and deceased, and the watch and boots of the deceased were traced his possession. The deceased had been seen with the watch up to within lf an hour of his disappearance. Mr. Macaulay, for the defence, contended t there was not sufficient proof in law that the remains found, were really ose of Collis. The finding of some portion of the clothes of this man in cesspool was not sufficient to prove the *corpus delicti*—the murder. ere must be positive evidence that the remains were those of Collis. Patteson, overruled the objection, observing that the identity of the remains was ogether a question for the jury. It was further contended for the defence, t there must not only be clear proof that the remains were those of the eased, but it must be proved that the deceased had died by the act of the soner, and not from any accidental cause. The prisoner was convicted.

But for the discovery of the clothes, more particularly of the two different oured garters round the leg bones, the identity in this case could not have been satisfactorily established. The suggestion that the deceased might have fallen into the cesspool by some accident was negatived by the fact that had this occurred, the watch and boots would have been found with the remains, whereas these articles were clearly traced to the possession of the prisoner. It is worthy of note that in this case, the dead human body, in clothes, was reduced nearly to the state of a skeleton within the short period of nine months. This must be ascribed to the influence of the putrescent animal matters by which it was surrounded. That the bones had not been for a longer period in the place where they were found, was proved by the fact that the cesspool had been cleared out only a short time before the disappearance of the deceased.

In July 1863, the bones of a child were found in a nursery ground at Islington, under suspicious circumstances. It appeared that a girl named *Elizabeth Hunter*, aged eight years, had been missing from the neighbourhood since March 30th, 1862, and it was important to establish, if possible, that these were the bones of a female child of the age of the deceased. Until the skull was found it was supposed that the bones were those of a dog, but their human character appears to have been ultimately established by the discovery of the skull with some hair, and also of the lower jaw. The medical witness at the inquest assigned the age at from eight to ten years, but could not well define the sex, as at this early period the sexual differences on the pelvis are not well marked. The articles of clothing found with the body served, however, to establish the sex, as well as the identity of the bones with those of the missing child. The remains had the appearance of having been longer in the earth than sixteen months, but it seems they were only superficially covered, and this might account for the rapid destruction of the bones and soft parts. It is probable that the bones of young persons decay more rapidly than those of adults. Cases involving medico-legal questions on the exhumation of skeletons after various periods of interment will be found in the 'Annales d'Hygiéne' for 1834, 1, 117; 1836, 1, 214; and 1845, 1, 379. See also 'Friedreich Ueber die Knochen in forensischer Beziehung. Ausbach,' 1853.

Human and animal Bones.—The greatest ignorance prevails among the public on this subject. The bones of horses, cows, dogs, and sheep are frequently mistaken for those of human beings. In an antiquarian collection of relics obtained from a neighbouring Roman castrum, I saw, some years since, the tibia of a dog carefully labelled and religiously preserved as a bone of an ancient Roman. The same collection contained fragments of bones of various animals, carnivorous and herbivorous, all marked as *human relics*; this collection belonged to an antiquary who had preferred adopting his own view of the nature of the relics, to taking the opinion of any one acquainted with anatomy. Even well-informed men may be easily mistaken on such subjects. Belzoni, the celebrated traveller, brought from Egypt, with his sarcophagi, a number of bones taken from the interior of the pyramids, which he pronounced to be the bones of King Cephrenes, and of some of the Shepherd kings. The late Mr. Clift, of the Royal College of Surgeons, informed me that by the request of a friend, he went down to examine them after they had been submitted to public exhibition, and he found that they were nothing more than the bones of oxen! The osseous relics of saints, as they are collected and preserved in glass and crystal cases in Roman Catholic countries, often present anomalies which would surprise an anatomist. Supernumerary ribs and vertebræ are not uncommon, and intermixed with them I have seen bones which certainly never appertained to a human being. I mention these facts because they show the importance of entrusting the examination of bones, in all judicial enquiries, to well-educated medical men. The lower classes of society are ever ready to suspect murder when bones are exhumed; and it will not always be easy to satisfy them that the exhumed bones could not have belonged to a human being.

The lamentable effects of popular ignorance were displayed in a case that occurred at Damascus in 1840, which at the time excited great public notice. A Roman Catholic priest, with his son, suddenly disappeared in the early part of that year, and a strong suspicion arose that they had been murdered. Certain Jews were charged with having murdered the father and son for horrible purposes. The sewer in the quarter of the town in which they lived was examined, and some bones were there found. These were pronounced by the persons who discovered them to be human bones; and the discovery was considered to confirm the suspicion of murder which had arisen. Several of the accused Jews died under the tortures to which they were subjected. It seems that the state of anatomy was so low in Syria, that there was no one competent to solve the question whether these were really animal or human bones. Some persons who inspected them, pronounced that they must have been lying in the sewer for a great length of time, and that they had belonged to an animal. A proposition was then made that the bones should be packed in a box, and forwarded to the Parisian Academy of Medicine, for their decision. I believe it was subsequently clearly proved that they were animal remains. Such a case is not likely to occur in England, for there are few professional men who would not be at once able to pronounce an opinion even from the examination of a fragment.

It will be, in most cases, easier to say whether a particular bone has formed part of a human skeleton or not, than to determine to what animal it may have belonged; this is commonly all that is expected from a medical witness. A moderate acquaintance with osteology will enable him to give an affirmative or negative opinion: but where part only of the shaft of a bone—as of the humerus, radius, tibia, or fibula—is produced, some caution is required in forming a judgment. It will not be necessary in this place to describe all the peculiarities of human bones, but rather to point out certain well-marked differences which are observed to exist between the bones of man and animals.

With respect to the *skull*, the foramen magnum in all animals, except the e-tribe, is placed very far back, and has its posterior edge turned upwards. the ape-tribe, and especially in the ourang-outang, it is nearer to the centre the base of the cranium than in any other animal, and is more nearly on a vel with the plane of the base of the skull. All animals, including the rang-outang and ape-tribe, have two bones in the face, in addition to those nd in man. These are situated between the superior maxillary bones, and e called ossa intermaxillaria, or, from their holding the incisor teeth, the sa incisoria. The suture which separates them from the maxillary bones comes obliterated in some of these animals at an early period; but still ces of it may be plainly seen. To speak of the facial angle as a mark of tinction is quite unnecessary; a medical opinion can never be required cept in those cases where only one bone, or the fragment of a bone, presented for examination. The lower jaw in animals is destitute of a tuberance corresponding to the chin; it is also longer, in proportion to the nium. The condyles of the jaw vary in shape according to the nature of food.

The trunk calls for no particular remark. The *vertebræ* are strikingly tinguished by their form, and by the direction of their spinous and nsverse processes. Their bodies are longer, and deeply grooved laterally, a vertical direction. The sacrum is generally narrower in proportion n in man; it is wide in those animals which occasionally stand erect, as in ape and the bear, but it is in these animals longer. The pelvis is in all s much elongated, is narrower, and has less of a basin-like appearance, level of the brim having a much greater obliquity than in man. The *rax* of animals without clavicles is commonly compressed at the sides, so as to render it much deeper from the sternum to the spine. This is especially observed in the dog, cat, bear, and in long-legged animals. The ribs, or fragments of ribs, might perhaps be occasionally confounded. Most mammalia possess more ribs than are found in man, the number corresponding to that of the dorsal vertebræ. The ribs vary much in form, but in herbivorous animals they are generally broad and thick; in the bear and dog they are more rounded. The sternum or chest-bone of the ourang-outang somewhat resembles that of man; it is flat but narrowed, and the division of its pieces is more apparent: in all other animals it differs in being considerably narrower, more or less of a rounded form, and in being evidently composed of many moveable pieces. Most quadrupeds want clavicles: they exist in the ape tribe, and very much resemble those of man, so that the clavicle of the ape might be easily mistaken for that of a young child: in the dog and cat, there is a clavicular bone suspended in the muscles. The scapula or blade-bone of animals, including the ourang-outang and ape, is much longer in proportion, and is more equally divided by the spine, the fossa infra-spinalis being much smaller in proportion than in man. The *os humeri*, or arm-bone, of animals, is observed to become short as the metacarpus is elongated: in the ape tribe, it very closely resembles that of man. In apes the bones of the fore-arm have the same general appearance as in man; but the two bones are long and slender, and the radius is as long as the ulna. In all carnivorous animals, the olecranon is extended farther back, and is more irregular than in man. The carpus, or wrist, in apes, has one bone more than in man. The size and strength of the thumb are much greater in man than in any animal. Even in the ape tribe, although separate and opposed to the other fingers, the thumb is very small and much shorter than in the human species. The *os femoris*, or thigh-bone, in most quadrupeds is so short that it scarcely projects beyond the abdomen: it varies in length according to that of the metatarsus. The neck of the thigh-bone is remarkably short, but the great trochanter rises considerably above the head of the bone even in the ape-tribe. In some animals, as in the horse, the trochanter ends in an unciform process projecting above the head of the bone. In the ourang-outang, the thigh-bone is straighter than in man, while in the bear it closely resembles the human bone. The bones of the leg in the ourang-outang are nearly as in man, but the *tibia*, or leg-bone, is in general considerably longer than the os femoris. In the bear it preserves a proper proportion. In the ape-tribe, these bones are nearly of equal length. In the dog, the fibula is placed behind the tibia, and is attached to it in its lower half. In the horse, the fibula forms merely a kind of splinter anchylosed by age to the upper part of the tibia. In the ruminantia, the fibula is wanting: in the pig it is anchylosed to the tibia throughout its whole length. In apes, while the great toe is shorter than the rest, the smaller toes are much longer than in man. In none of the mammalia, except man, does the foot rest completely on the ground. The os calcis generally wants the tuberosity of the heel; but this exists in the ape-tribe, although to a less extent than in man.

Such are the most prominent differences usually assigned by anatomists to the bones of animals, and based on the observations of skeletons. It is not improbable, however, that in some cases, assistance may be derived from the use of the microscope. This instrument may be especially serviceable in those cases of difficulty in which an opinion may be required from only minute fragments of bone. The Haversian canals and bone-cells (lacunæ) exist in all classes of animals which have a bony skeleton; and it has been shown that the bone-cells differ in size in the four great classes of animals. They are smallest in birds, and largest in reptiles: in the mammalia they occupy an intermediate position. In fish, they are entirely different in appearance from those existing in the other three classes. These bone-cells are said to be of the same size in the same class: thus, among mammalia, they are no larger in the bones of a horse, than they are in those of a mouse. In human bone, the cells are sometimes almost triangular in outline, at other times they have more of a linear or elongated shape. Their number is in an inverse proportion to the Haversian canals in bone. It is desirable that further observations should be made on this subject; and that differences in the microscopical structure of bone should be sought for in the human subject, and in the various orders of mammalia. The late Mr. Quekett ascertained that the cells of bone bore a certain relation, in point of size, to that of the blood-discs of an animal; thus, for instance, the blood-discs were found to be largest in reptiles, smallest in birds and mammalia, while in fishes, they were of an intermediate size: and he further discovered that the bone-cells followed the same law. ('Med. Gaz.,' Dec. 11, 1846.) It has happened on several occasions of late years, in cases of infanticide, that great difficulty has been experienced in identifying small portions of bone, when the skeleton has been found partially consumed by fire.

When it has been clearly proved that the bones are not those of a human being, this branch of the inquiry is at an end.

Determination of Sex in Skeletons.—The determination of the sex from an examination of the skeleton or of certain detached bones, can be made only in subjects which have passed the age of puberty; for sexual differences in the skeletons are scarcely apparent until adult age has been reached. I have, however, seen the well-marked sexual differences of the pelvis in the skeleton of a boy of eleven. The skeleton of the female is smaller and more slender than that of the male. The full-grown bone of a female, is distinguished from that of a male, by its ridges, depressions, and processes being less marked,—the shaft is smoother and more polished, while the articular surfaces are flatter. The skull of the female is more contracted in front, and forms a longer oval from before backwards. The chest, which is naturally shorter, smaller, and less prominent than in the male, is somewhat wider about the fourth rib: it then contracts somewhat below, so that while the general shape of the chest approaches to an oval in the female, it is conical in the male skeleton, being wider at the base or lower part. The form of this cavity is often flattened laterally to a considerable extent, owing to the pressure of the stays worn by females. This altered condition of the ribs by pressure, may serve to indicate the sex. The sternum is shorter, terminating opposite the fourth pair of ribs, but its upper portion is larger than in the male; in the latter it terminates opposite the fifth pair of ribs. The ribs are shorter, more slender, and less arched, and take a more horizontal course in the female: their upper and lower borders are sharper. The false ribs are proportionately larger; and the cartilaginous portions of the true ribs are onger than in the male. The shoulders are lower, and the scapulo-humeral articulations nearer to each other. The clavicles are more slender, more round, and pass in a more straight direction to join the acromion processes. n the male they have somewhat the form of the italic *S*: they are atter, larger, and run more directly backwards. The female scapula is hinner, smaller, flatter, and has sharper angles than that of the male. The bodies of the vertebræ are smaller, the hole for the spinal marrow and the oramina are larger; and the lumbar vertebræ have greater length than in he male.

The upper limbs are shorter, the carpus smaller, and the metacarpus and halanges are more slender in the female than in the male. The thigh-bones ave a greater curvature forwards at the upper part, and are turned ore obliquely inwards, below. The neck of the thigh-bone in the female, forms nearly a right angle with the shaft, whereby the trochanter major is brought more nearly on a level with the head of the bone. In the male the neck of the femur is inclined obliquely upwards, and the trochanter major is below the level of the head. In the female the internal condyles are larger. The bones of the leg are more slender, and those of the feet are smaller than in the male.

The most remarkable difference is observed in the *pelvis*, and it is by an examination of this portion of the adult skeleton, when it can be obtained, that the sex may be most satisfactorily made out. In the female the ossa ilii are flatter and more everted, giving to the whole pelvis a greater capacity; the os sacrum is broader, and turned more backwards; the os coccygis more slender, moveable, and turned more backwards, the space between the ossa pubis larger, and the cartilage of the symphysis, broader. The angle formed by the rami of the ossa pubis with the symphysis is larger. In a well-formed male skeleton I have found the angle to be 73°, while in a well-formed female skeleton the angle was equal to 90°. The tuberosities of the ossa ischii are flatter, and at a greater distance from each other. The brim of the pelvis is wider and of an oval form, corresponding with the head of a child, and the longest diameter extending between the ilia, or transversely. In the male the brim is more circular, and the greatest diameter is between the pelvis and sacrum. The foramina ovalia in the female are wider, and approach more to a triangular form than in the male, one sharp angle being at the junction of the pubis with the ischium; the acetabula are farther distant from each other. The pelvis of the female loses some of its well-marked sexual characters in advanced life.

It will be understood that these differences are for the most part relative, and some are so slight that they can scarcely be regarded as characteristic of the sexes. Great difficulty in forming an opinion will exist in those cases where only a fragment of a bone can be procured; but a medical witness is not expected to work out impossibilities: if he has a sufficient portion of a skeleton before him, he may be able to determine the sex, otherwise it would be advisable to state that the remains produced did not enable him to answer the question, and that the bone or a fragment might have belonged either to a male or a female.

In a contested case of presumption of survivorship which occurred some years since, it became necessary to determine the relative weights of the adult male and female skeletons. A perfect male skeleton from Guy's Museum, was found to weigh ten pounds, six ounces: and a perfect female skeleton eight pounds, thirteen ounces. The bones were completely dry. It may be observed that bone is the heaviest part of the human body; its specific gravity is 2·01.

Period of Interment.—One of the first questions asked on the disinterment of bones, relates to the length of the period during which they may have remained buried in the ground. The period at which the bones begin to undergo decomposition, will depend upon that at which the soft parts have entirely disappeared. The common opinion is, that the soft parts are destroyed in ordinary graves in about ten years. Bernt, however, mentions a case seen by Navier, in which some fleshy parts of the body remained after an interment of twenty-one years. The changes in the bones are observed to commence by the loss of animal matter, so that they become lighter; externally they acquire a dark incrustation when in contact with the earth. This dark incrustation is sometimes confined to the surface; but in some very ancient bones in my possession, the osseous shell is of a dark-brown colour throughout, like oak. The animal matter is never entirely lost; it exists in bones which have been buried for many centuries, and may be made evident by digesting them in hydrochloric acid. Even in sawing them, the heat of friction brings out a peculiar animal odour. The shaft of a long bone becomes, after long burial, very brittle; it may be easily broken, and cut or scraped with a knife. It appears to me to be impossible to assign with any approach to precision, the period required for the production of these changes; they vary with the age of the subject, taking place more rapidly in the skeletons of the young: they vary also with the nature of the soil in which the bones are buried, according to whether this is dry or humid, sandy, cretaceous, or argillaceous. Some have alleged that the bones of a person buried in an ordinary coffin are entirely destroyed, with the exception of the skull and thigh-bones, within a period of thirty years; but I have seen a perfect skeleton of the body of a male that had been buried in a dry soil for thirty-four years (p. 61); and there are many cases on record, where the skull and long bones have been found, in ordinary graves, quite perfect after a much longer period than thirty years. In general, the lower jaw of adults is preserved for a great length of time, and with it the teeth, which from the hardness of the enamel resist decomposition longer than any other parts of the body. The ultimate destruction of the bone is effected by the complete disintegration of its earthy parts, the phosphate and carbonate of lime falling into and mixing with the earth around. Bones owe their preservation to the large proportion of mineral mattter contained in them. This is greater in the adult than in the child. Von Bibra found the following proportions per cent. of mineral matter in bones of different ages:—In a woman (æt. 62), 69·82: in a man (æt. 25), 68·97: in a child (æt. 5), 67·80: in a child of two months, 65·32: in a fœtus of seven months, 65·19: and in a fœtus of six months, 59·62. The proportions in the bones of animals, are similar to those of the human adult.

On the discovery of one or more bones, the question may be: Can it have been buried for a longer period than fifteen or twenty years? Suspicion may arise that it was the bone of a person alleged to have been murdered, and who was known to have disappeared about that period. In some cases this question may admit of a ready answer. If it were the long bone of an adult, and it was found to be light, friable, brittle, and easily scraped to powder, it is probable that it had been interred for a much longer period than that supposed. We can form only a rough opinion of the period of interment of bones, by the presence or absence of the soft parts; of marrow in the interior; by the firmness and weight, or brittleness, dryness, and lightness of the bone. Even these remarks can scarcely be made applicable to bones preserved in durable coffins; for in this state they are removed to a great extent from all the common causes of chemical change. Devergie states that the bones of King Dagobert were found in a tolerably perfect state at Saint Denis, although they had been buried in a vault twelve hundred years.

It is a question which has yet to be determined, whether, as it is stated to be the case with the fossil remains of animals, human bones after long interment may not contain a larger proportion of fluoride of calcium than when recent. It has been ascertained that the ancient bones of extinct animals contain a large proportion of the fluoride, while in recent bones the proportion is so small that it requires a large quantity of bones to determine its presence.

It need hardly be observed, that these medico-legal questions arise only in those cases where the bones have been found in an unusual locality, as in the cellar of a house or in a garden: and it will always be proper to make further exploration to see whether the bones of different persons may not be found lying near.

Determination of Age in Skeletons.—In regard to the remains of the young, the age may be best determined by an examination of the jaws and teeth, although the skeleton of the young is characterized by the smallness of the bones. If the jaw of a child can be found, medical evidence may be given of its probable age. In a case of alleged infanticide, which occurred in France, there were found among the exhumed bones of two children, parts of the jaws, containing the rudiments of the molar teeth, which appear about the eighth or ninth month of pregnancy. This fact showed, what was rather important to the enquiry, that the child to whom the jaw belonged must have been born at or about the full period.

It may be alleged that the bones are those of a child which has been murdered; but the medical witness may be able to prove, by an examination of the jaws, that the bones must have belonged to a child older or younger than that which is missing. There are numerous other cases in which a question of this kind may become important.

The determination of age by an examination of the bones of young subjects, is by no means so satisfactory as by the observation of the *teeth.*

The alveolar cavities which contain the teeth are said to be formed about the sixth month of uterine life. At birth the rudiments of the whole of the temporary teeth, and of the anterior permanent molars, are formed in capsules within the gums; and about this period, the fangs of the incisors begin to appear. Great difference of opinion exists respecting the time at which the *temporary teeth* begin to rise above the gums in a child after birth. According to Mr. Bell, these teeth appear in the following order:—The four central incisors in from *five to eight months*; the four lateral incisors in from *seven to ten months*; the four anterior molars in from *twelve to sixteen months*; the four cuspidati in from *fourteen to twenty months*; and the four posterior molars in from *eighteen months to three years.* The temporary are known from the corresponding permanent teeth by their much smaller size, by the absence of bicuspides, by the fact that the fangs diverge at a greater angle from the molars; and there is another and remarkable point of difference, according to Mr. Saunders, namely, that the enamel at the neck is collected into a kind of ridge, instead of terminating, as in the permanent set, evenly on the fang. This is especially apparent in the incisors and cuspidati, but, as Mr. Saunders has remarked, it applies to all the temporary teeth. Between six and seven years of age, the jaws contain forty-eight teeth—twenty of the temporary set in a perfect state, and twenty-eight of the permanent set more or less developed and placed behind the temporary teeth which they are to replace. According to Mr. Saunders, the order in which the permanent teeth appear is as follows:—At *seven* years of age, the four anterior molars; at *eight* years, the four central incisors; at *nine* years, the four lateral incisors; at *ten,* the four anterior bicuspides; at *eleven*, the four posterior bicuspides; at from *twelve* to *twelve and a half* years, the four cuspidati; and at from *twelve and a half to fourteen* years, the four posterior molars: thus making the total number of teeth in the jaw at this period twenty-eight. The dentes sapientiæ seldom make their appearance before the age of eighteen, and often not until a much later period in life. In general, the teeth of the lower jaw make their appearance before those of the upper. Some irregularities may occur in the periods at which the teeth appear; but according to numerous observations made by Mr. Saunders and others, the description just given, is applicable to a large majority of cases, and is sufficiently correct for practical purposes.

In addition to the examination of the teeth, medical jurists are accustomed to rely upon the progress of ossification in the skeleton, as furnishing evidence of age at the early periods of life. At *one year*, ossification commences in the lower extremities of the humerus and ulna, in the heads of the femur and humerus, and in the upper cartilage of the tibia. At *two years*, ossification takes place in the lower cartilage of the radius, and in the tibia and fibula. At *two years and a half*, it takes place in the greater tuberosity of the head of the humerus, in the patella, and in the lower ends of the four last metacarpal bones; at *three years*, in the trochanters; at *four years*, in the second and third cuneiform bones of the tarsus; at *four and a half years*, in the small tuberosity of the head of the humerus, and the upper cartilage of the fibula; at *six years*, the descending ramus of the pubis meets the ascending ramus of the ischium. At from *eight to nine years*, the upper cartilage of the radius becomes ossified. At *nine years*, the ilium, ischium, and pubis, meet in the cotyloid cavity to form the pelvis. At *ten years*, ossification begins in the cartilaginous end of the olecranon; at *twelve*, in the os pisiforme of the carpus; at *thirteen*, the three portions of the ossa innominata still admit of separation into ilium, ischium, and pubis, although nearly united; the neck of the femur is ossified. At *fifteen*, the coracoid process is united to the scapula; and *between fifteen and sixteen*, the olecranon to the ulna. From *eighteen to twenty*, the epiphysis at the upper end of the thigh-bone is joined to the body of the bone; as well as those belonging to the metacarpus, metatarsus, and phalanges. At *twenty*, the upper and lower epiphyses of the fibula, as well as the lower epiphysis of the femur, are respectively united to the bones. At *twenty-five years*, the epiphyses of the sternal end of the clavicle, and of the crista ilii, are united to the bones. This account of the progress of ossification may be taken as a representation of average results.

In the cavity of the skull of young subjects, the furrows produced by the convolutions of the brain and by the vessels, are commonly very strongly marked on the bones.

When ossification is once completed, it is difficult to determine the age by an examination of the bones. That the person has reached *adult age*, will be indicated by the union of all the epiphyses to the bones, by the great firmness and solidity of the bones, with their rough surfaces for the motion of muscles, their well-marked processes, grooves, and foramina. In the jaws, we may expect to find the dentes sapientiæ; while the other teeth will probably be found much worn, although this last sign is not of any great importance. The lower jaw forms a great angle, being somewhat of an elliptical form, and is strongly contrasted with the semicircular shape of the jaw at an early period of life; the sutures are also closed, and are found in some instances nearly obliterated.

The bones of an old person are generally lighter than those of an adult of the same size, the medullary cavities of the long bones being larger. The bones lose that ivory-looking character which they have in adults, become yellow from the quantity of oil which they contain, more earthy, and brittle. Those parts of the skeleton which are cartilaginous in adults, are commonly more or less ossified in old age. The bones of the cranium are thinner; the sutures entirely disappear, first on the inside, and then on the outside of the skull. The teeth have either dropped out, or the crowns are worn away to the sockets. Sometimes no trace of alveolar cavities is to be seen, the lower aw being a mere rounded bone, with a smooth surface on each side.

Identity from the Teeth.—Observations carefully made on the state of the aws and teeth may have an important bearing in cases of disputed identity. The loss of particular teeth, the presence of supernumerary teeth, or the entire absence of teeth for a long period, may, if noticed by the medical inspector, lead to the removal of many difficulties in the identification of skeletons. An instance of this kind occurred to me some years ago in a case which Mr. H. Reynolds and myself were called upon to investigate. It was a trial or murder under circumstances in which the body was never discovered, and n which, as it happened, an important question of identity arose, founded on he presence of the incisor teeth in a female of advanced age. The case to which I allude is that of *Elizabeth Ross*, who was tried at the Old Bailey

Sessions in December 1831, for the murder of a female of the name of Caroline Walsh.

It appeared in evidence, that the deceased, Caroline Walsh, who was an old Irishwoman, had been repeatedly solicited by the prisoner to come and live with her and her husband, but the deceased refused. By much persuasion on the part of the prisoner, however, she at last consented, and went for that purpose to the prisoner's lodgings in Goodman's Fields on the evening of August 19, 1831, taking with her, her bed and an old basket, in which she was accustomed to sell tape and other articles. From that evening all traces of the deceased were lost; and when the prisoner was required by her relatives to account for her disappearance, she prevaricated, but finally asserted that deceased had gone out early on the morning of that day, and had not returned.

The testimony of the prisoner's son, who was the chief witness for the Crown, went to prove most clearly, that the deceased had been wilfully suffocated on the evening of her arrival, by his mother (the prisoner) placing her hands over the mouth of the deceased, and pressing on her chest. He deposed that on the following morning he saw the dead body of the old woman lying in the cellar of the house, and on the evening of the same day, he saw his mother leave the house with something large and heavy in a sack. This was at the time when murders were perpetrated in London to supply the Anatomical Schools with subjects for dissection.

Now it happened most singularly that on the evening of August 20, the day following the alleged murder, an old woman of the description of the supposed deceased, was found lying in the street in the immediate neighbourhood, in a completely exhausted condition, and in a most filthy and squalid state. On being questioned she stated that her name was Caroline Welsh, and that she was a native of Ireland. Her hip was found to be fractured, in consequence of which she was conveyed to the London Hospital, where she subsequently died and was buried. The prisoner Ross, when apprehended, insisted that this was the female whom she was accused of having murdered. Hence, setting aside the direct contradiction given to this statement by the evidence of her son, it became highly important for the ends of justice, that the identity or non-identity of the two women should be clearly established.

The extraordinary resemblance of names, and the exact coincidence of time and place, struck every one in court; but by the examination of about twenty witnesses, the following points of difference were elicited. It was proved that they were both Irishwomen, but Caroline Walsh came from Kilkenny; Caroline Welsh, from Waterford. The former (the alleged murdered person) was eighty-four years of age; tall; of a sallow complexion; grey hair, and had (an extraordinary circumstance for her years) very perfect incisor teeth. The latter, Caroline Welsh (who died in the London Hospital) was about sixty years of age; tall of stature; dark like a mulatto, but had no front teeth, in addition to which it was deposed by a medical witness that the alveolar cavities corresponding to them *had been obliterated for a considerable time.* The witness brought the skull and jaw into Court,—for the body had been purposely exhumed for this examination;—but the judge (the late Lord Denman, then Recorder of London) would not allow it to be produced, and said he would be satisfied with the witness's statement respecting the condition of the jaws.

Other circumstantial points of difference were deposed to,—as, for example, Caroline Walsh was healthy, cleanly, and neat in her person, and her feet were perfectly sound. Caroline Welsh was considerably emaciated; she was in a dirty and filthy condition; her hip was broken, her feet were covered with bunions and excrescences, and one toe overlapped another.

The dress of the two women was somewhat similar. That of Caroline Walsh was most clearly proved to have been sold by the prisoner Ross to different persons; and almost every article was reproduced in Court, and sworn to by witnesses. The clothes of Caroline Welsh were proved to have been burnt by order of the parish authorities. Both of these women had similar baskets in their possession; that of Caroline Walsh had no lid or cover, while that found on Caroline Welsh had. Lastly, the body of the latter was taken up from the burial-ground of the London Hospital for the purpose of identification, and it was sworn by two of the grand-daughters of Caroline Walsh not to be the body of their grandmother.

This is perhaps one of the most singular cases of disputed identity that has come before a British Court of law. We have a coincidence of name, time, place, age, occupation, and circumstances, so extraordinary, that but for two circumstances it is probable the prisoner would have escaped on the presumption of a mistake, the body of the deceased never having been found, although all the dissecting-rooms in London were repeatedly searched for it. These circumstances were—1st. That the relatives of the deceased swore that the exhumed body was not that of the missing woman; and 2nd, the medical proof of the entire obliteration of the alveolar cavities in the jaw of the exhumed body, proving that the incisor teeth must have been lost long before death, while several witnesses testified to the presence of these teeth, as a striking peculiarity in the missing woman. Even had the features of he exhumed body been obliterated by putrefaction, the non-identity would have been established by this medical fact. The prisoner was convicted and executed.

In February 1864, a man named *Weekly Ball* was charged with the murder of a woman named Lydia Atlee, with whom he had cohabited. It ppears that, while in the last stage of pregnancy, she had suddenly disappeared n July 22, 1850 and was never seen again. It was rumoured that she ad been murdered, and the prisoner who, it was alleged, had a strong motive for getting rid of her, was suspected of the act; but no legal proof ould be obtained against him, and the matter dropped. On February 3, 1864, s a labourer was digging in a lane, by the side of a ditch near the village f Ringstead, in Northamptonshire, where deceased and the accused had ved, he found a human skull and ultimately a skeleton, lying at full length ith its face downwards. The medical evidence at the magisterial enquiry as to the following effect: The skeleton was lying in a trench about twenty nches below the surface of the ground in a swampy soil. The feet were ose together, the heels touching each other, From these facts Mr. Leete, the urgeon, expressed an opinion that the body must have been buried naked. he skeleton when laid out, was that of a middle-aged female, about five feet wo inches in height. The bones were complete, excepting the right thigh-one and skull, which were broken in their removal. He considered that he skeleton had been in the earth from twelve to twenty years. The woman as far advanced in pregnancy, but no *fœtal bones* were found. In reference this, the surgeon stated that the fœtal bones contained more animal matter, nd might have been decomposed, although he declined to swear that within e period of fourteen years, they would have been entirely obliterated. No air was found, although sought for, and no traces of clothes of any kind uld be discovered; but there was a singular fact connected with the lower w, by which it was supposed the skeleton could be identified as that of e missing Lydia Atlee. A labourer stated that a *fortnight* before the woman as missing, he drew a double tooth from the lower jaw (the first molar on e left side). When the exhumed jaw was shown to him, this tooth was sent, and he affirmed that that was the place where he drew the tooth.

He thus appeared clearly to identify the skeleton as that of the missing woman. The evidence of other witnesses was adduced to show that on the evening of July 22, 1850, the accused and Lydia Atlee were seen to go together into an orchard at the back of the accused's house. They were overheard quarrelling, and the woman's voice was identified, muttering the words, 'I believe you mean killing me to night.' It appeared that the skeleton was found buried about a mile from this orchard.

Dr. Markham, who also gave evidence on the case, said in reference to the pregnancy of the woman, if it was a nine months' fœtus, some of the fœtal bones ought to have been found with the skeleton: the hair might have disappeared in thirteen years. With regard to the lower jaw, he observed that if the tooth was extracted, it could not have been taken away long before death. The cavity was partly filled up, which might be explained by its having been extracted without one or all of its fangs.

Although the identity of the skeleton, as that of the missing woman, was thus left a little uncertain, the accused was committed for murder. In the meantime the ground was again searched for fœtal bones, and the result was that, about eighteen inches deeper in the earth, the skeleton of a full-grown man was found, foot to foot with that of the female skeleton above. That of the man was lying on its back and the bones appeared to have been much longer in the ground. On this discovery, it was suggested that the spot might have been a gipsy's burial place, in which one body was laid in a grave over another without the ordinary clothing.

That the accused should select a spot a mile away from his dwelling for burying the body of a woman whom he was alleged to have murdered, and that he should then place the body at full length, over another dead body just below it, was most improbable. The entire absence of the fœtal bones was another fact adverse to the alleged identity. I am assured by an eminent dentist who examined the lower jaw, that the tooth, supposed to have been drawn a fortnight before death, is one of the most common teeth to be absent in the jaws of middle-aged persons, and further, that it might have been removed from the jaw for three months or more before death. There was nothing by which a more recent period could be fixed, as part of the cavity had been filled up by the usual osseous structure. At the Northampton Lent assizes, 1864, the accused was discharged on bail.

Questions of identity may turn, not only on the number and nature of the natural teeth, but also on the presence of artificial teeth, with the mechanical appliances for securing them. On the trial of *Professor Webster* for the murder of Dr. Parkman (p. 88), the evidence given by a dentist, Dr. Keep, established the identity of the mutilated remains of the deceased, in spite of an attempt which had been made to destroy the jaws by fire. This gentleman deposed that, about four years previously, he had made and fitted for Dr. Parkman sets of artificial teeth in blocks for each jaw. He saw Dr. Parkman with these teeth in his head, for the last time, about a fortnight before his disappearance. He then put a new spring to the teeth. He recognized the artificial teeth, taken from a furnace, by certain peculiarities about them, and also by their fitting the original plates and moulds, which he retained in his possession. The gold plates attached to them had been melted in an assay furnace, in an attempt to destroy the head of the deceased, but the greater part of this gold was recovered, and the artificial teeth, to which the gold plates had been fastened, had acquired a pink colour from a portion of the finely divided metallic gold, showing that they had been submitted to a high temperature, but had not undergone fusion, although minute particles of gold were fused into them. The left side of the lower jaw presented a great natural irregularity. The block corresponded to this, and thus placed the identity of the jaws beyond dispute. ('Report of Trial of Prof. Webster,' Boston, 1850, p. 50.)

Bones and teeth which have been long buried, may, by percolation of water through the soil, become impregnated with oxide of iron, sulphate of lime, or the carbonates of magnesia and lime. They generally contain much lime. In some bones, disinterred near one of the plaster quarries of Paris, Lassaigne found, besides 66·7 of the usual mineral constituents, 2·3 per cent. of sulphate of lime, with traces of oxide of iron. Other bones, of soldiers killed in 1814, and buried near the same spot, yielded 56·1 of sub-phosphate and carbonate of lime, 0·5 of sulphate, and 8·2 per cent. of argillaceous sand. These bones had been buried for a period of thirty-three years. They contained 15 per cent. of animal matter and 20 of water. Those taken from the plaster quarry, contained the same quantity of water, but only 11 per cent. of organic matter. ('Annuaire de Chimie,' 1847, p. 759).

Determination of Stature.—The average stature of Englishmen is from five feet six to five feet nine inches; although about four out of one hundred are calculated to have a stature of from six feet to six feet three inches. In determining the stature from the measurement of the entire skeleton it is usual to add from an inch to an inch and a half for the thickness of the soft parts. When the bones are entirely disarticulated, they must be laid out in their natural order, and an estimate made. Medical jurists have endeavoured to determine the stature of a skeleton from the measurement of one or more of he long bones—as, for example, of the femur, tibia, fibula, humerus, radius, and ulna; but the rules for this mode of calculation are unsatisfactory: and as M. Devergie has clearly shown from the tables, they are liable to lead to an error of five inches at the least. The fact is, there does not appear to be any uniform relation between the length of these individual bones and the tature of a person. In tall persons it is observed that the bones of the lower imbs are proportionably longer than those of the upper; but we are liable to meet with all kinds of anomalies, and the best that can be said of this mode f measurement is, that it can never be proved wrong: for in general there an be no witness to speak to the stature of the person while living, in cases n which a medical investigation of this kind is directed to be made.

We advance very little to a solution of this question, even by deducing the verage length of a long bone from the measurement of a large number of imilar bones. The differences in the length of the bones, will be great ccording to whether the measurement is made from the edge of one articular urface to the other, or whether the processes are included or excluded, such s the styloid process of the ulna and the inner malleolus of the tibia.

I have below drawn up the measurements of three adult male skeletons, hich were taken as accurately as possible by the repeated examination f the numerous skeletons in the museum of Guy's Hospital. Nos. 1 and 2 omprise nearly the average stature of Englishmen; No. 3 represents the keleton of a tall man. The height here is the bare measurement of the bones ith the soles of the feet resting on the ground: an addition of at least an nch should be made for the soft parts. The lengths of the tibia and fibula, ere taken between the articular surfaces. From end to end the fibula is remarkably long bone. I have found it in adults to be in many cases long as fifteen inches.

Adult male Skeletons.

	No. 1.		No. 2.		No. 3.	
	Ft.	In.	Ft.	In.	Ft.	In.
Stature (sole on the ground) .	5	6	5	9	6	0
Transverse measurement from extremity of middle fingers	5	$6\frac{1}{2}$	5	$10\frac{1}{2}$	6	1
Femur . .		$17\frac{3}{8}$		18		$19\frac{1}{2}$
Tibia } between { art. surf.		$15\frac{3}{8}$		$14\frac{3}{4}$		$15\frac{1}{2}$
Fibula } between { art. surf.		$13\frac{1}{2}$		14		$14\frac{1}{2}$

	No. 1.		No. 2.		No. 3.	
	Ft.	In.	Ft.	In.	Ft.	In.
Humerus . .		12		12		$13\frac{1}{4}$
Radius . .		9		$9\frac{1}{4}$		$9\frac{3}{8}$
Ulna . . .		10		$10\frac{3}{8}$		$10\frac{3}{8}$
Clavicle . .		$5\frac{6}{8}$		6		6
Hand from carpus, joining the radius . .		7		$7\frac{1}{4}$		$6\frac{1}{2}$

The subjoined table contains the measurements of two female skeletons; the one of an adult, the other of an aged woman.

Female Skeletons.

	Adult Female.		Aged Female.	
	Ft.	In.	Ft.	In.
Stature . .	5	$2\frac{1}{2}$	5	
Transverse length	5	$2\frac{1}{2}$	5	$\frac{3}{4}$
Femur . .		16		16
Tibia . . .		$12\frac{3}{4}$		$12\frac{1}{2}$
Fibula . .		$12\frac{1}{2}$		$12\frac{1}{4}$
Humerus . .		$11\frac{1}{8}$		$11\frac{1}{4}$

	Adult Female.		Aged Female.	
	Ft.	In.	Ft.	In.
Radius . .		8		$7\frac{7}{8}$
Ulna . . .		9		$8\frac{3}{4}$
Clavicle . .		$5\frac{1}{2}$		5
Hand from the wrist . .		$6\frac{1}{2}$		$6\frac{1}{4}$

These are the measurements of the bones of the arm of a well-formed soldier.

Arm of a Soldier.

	Inches.
Humerus	$12\frac{1}{2}$
Radius	$9\frac{1}{4}$
Ulna	$10\frac{1}{4}$
Clavicle	6
Hand from wrist . . .	$7\frac{3}{\text{[illegible]}}$

	Inches.
Total length of arm . . .	$29\frac{1}{2}$

$29\frac{1}{2} \times 2 = 59$
Clavicles 12
Sternum $1\frac{1}{2}$
Stature about 6 feet.

The following are full-length measurements of perfect but detached bones of a male skeleton used for anatomical demonstration:—

Detached Bones of a male Skeleton.

	Inches.
Femur	18
Tibia	$15\frac{1}{4}$
Fibula	15

	Inches.
Humerus	$12\frac{3}{4}$
Ulna	$10\frac{1}{4}$
Radius	$9\frac{1}{4}$

In the course of these investigations an attempt was made to determine whether there was any correspondence between the transverse length of the skeleton, measured from the extreme ends of the phalanges of the middle fingers, the arms being maintained in a horizontal position. It will be seen that both in the male and female, there is a very near approximation in these measurements. We have only the bones of the arm of a male adult; we may, by doubling its length, and adding twelve inches for the two clavicles, and an inch and a half for the sternum, determine approximatively the stature. Thus, by applying this rule to the arm of the soldier, of which the measurements have been just given, we should have a stature of six feet. This method of taking a whole extremity, although only approximate, is likely to lead to less error than that of determining the stature by the measurement of a solitary bone.

Below are two measurements, the one of a male skeleton between *ten and eleven years of age*, the other of a mature child at the end of *nine months'* utero-gestation. The dried cartilages at the ends of the long bones are not included in the measurement of the latter, because they are never found in graves; we have merely the osseous portions to examine.

	Male Skeleton naturally articulated. Ft. In.	Mature Child at 9 months. In.
Stature	3 10	19¾
Femur	11¾	3
Tibia	9¾	2⅝
Fibula	9½	2½
Humerus	8½	2¼
Radius	6	2
Ulna	6¾	2¼
Clavicle	4	1⅝
Hand from wrist	5	2
Arms, each		8¼
Measurement across the chest		3¼

Béclard remarks on the stature of the body, as determined by the dimensions of the skeleton, that it is about five feet four inches for an adult male, and about five feet for an adult female; but it is subject to great variation, not merely in the various races of men, but in individuals of the same nation. These extremes, however, are comprised within certain limits. Thus dwarfs (as adults) are rarely less than one-half of the average stature, while giants are seldom more than one-half above the average.

Determination of Age from Stature.—In attempting to determine the age of a skeleton from the measurement of the bones, it must be remembered that there is a great difference in the rapidity of growth, not merely in children of the same sex, but in children of different sexes. Sometimes a child will be much under the average stature before puberty, but will rapidly grow after having passed this period: hence the subjoined table, taken from M. Süe, is scarcely available for practical purposes. We must, at any rate, allow of the possible existence of great deviations. Here is the table, somewhat modified by additional observations.

Age.	Stature. Ft. Ft. In.
At one year	2 to 2 3
,, three years	3
,, ten to twelve	4
At fourteen to sixteen	4 to 5
,, twenty to twenty-five	5 to 5 6

The full stature, however, according to some recent observations, is rarely attained until the age of from twenty-five to twenty-seven years. This table efers to the stature of living persons; it will be somewhat less for the keleton.

M. de S. Luca has recently brought before the Academy of Sciences the esults of his researches on the relative length and weight of the bones which onstitute the human skeleton. ('Cosmos,' Oct. 2, 1863, p. 386.) He has emonstrated the existence of relative proportions among parts of the body which had not previously been suspected. His view is, that in the construction f animals there is among the various organs, a uniform relation of weight, ength, and surface. The average stature of an adult man is, according to im, five feet three inches (1 mètre, 60 centimètres), that of an adult woman ne-twentieth less, *i.e.* within a small fraction of five feet. The head forms ne-eighth part of the total height of the body: this is divided into two equal arts immediately below the eyes, while the nostrils are midway between the yes and chin. In a vertical section of the body, the pubis is a central point etween the two extremes. When the arms are raised vertically above the ead, the umbilicus or navel, which is one mètre (39.37 inches) from the sole f the foot, then becomes the centre of the length. It may be further emarked that the height of a man corresponds to the distance which separates he extremities of the two hands, when the arms are extended in a horizontal ne from the body (p. 108). The arm may be divided into five parts, the and representing one part, while two others are occupied by the forearm, and he remaining two parts by the upper arm, the elbow being the boundary of these divisions. Whatever the length of the hand, five times that length will represent the total length of the arm, so that if the hand is 133 millimètres (5.22 inches) the arm will be 666 millimètres (26.13 inches) in length. In reference to the hand, the carpal and metacarpal bones represent one half of its length. The first phalanx of the middle finger is equal to one-fourth of the hand, and the two last phalanges of this finger, taken together, are exactly equal to the length of the first phalanx. The last phalanx is itself naturally divided by the nail into two equal parts. The sole of the foot is a third longer than the palm of the hand, but the back of the foot or instep is of the same length. The observations made on the weight of the bones showed: 1, that the bones of the right side of the body were heavier than those of the left. 2. The weight of the bones above the navel is equal to the weight of those which are below that point. 3. The weight of the bones of the hand is equal to the fifth part of the weight of the bones of the arm. There is the same relation here as in length. 4. The total weight of the hand may be divided into five equal parts, one represented by the carpal, two by the metacarpal bones, and two by the bones of the fingers. The first phalanx is equal to two-thirds of the weight of the entire finger, the other third being represented by the two remaining phalanges. 5. The bones of the hand are equal to half the weight of the bones of the foot. 6. In the foot there are similar relations. The weight of the tarsal is double that of the metatarsal bones, and the weight of the toes is divided into three parts, two for the first phalanges and one for the two small phalanges.

Difference of Race.—There are certain differences in the skeleton, according to whether it belongs to an individual of the Caucasian, Mongolian, or Negro variety of mankind. The differences chiefly relate to the proportion which the skull bears to the face, and the relative lengths of the upper and lower extremities. In the Caucasian the skull is rounded, the forehead raised, and the facial portion small in proportion to it. In the Mongolian, the upper and lower extremities are small, the cranium more of a square form, the forehead inclined, and the face large and flattened; the malar bones being especially prominent. In the Negro the proportions of the skeleton are smaller in the lumbar and pelvic regions; the upper extremities are long in proportion to the body, and the forearm and leg are large in proportion to the arm and thigh; the hands are small, the feet wide and flat, and the ossa calcis projecting much backwards. The skull is narrow and elongated, the forehead small and compressed, the malar bones and jaws projecting, and the teeth placed obliquely, so as to form a considerable angle at their point of union.

The most marked characteristics exist in the configuration of the skull; but the skull of Ho Loo (a Chinese), in the Guy's Museum, scarcely possesses the characters assigned to the Mongolian; it closely resembles the skull of the Caucasian. That of the Negro may be more clearly identified. The skull of the Hindoo is a mixture of the Negro and Caucasian. It would be difficult, if not impossible, to pronounce an opinion of the race to which the skeleton belonged, from a few detached bones or parts of bones.

Identity from Fractures.—With regard to other circumstances connected with the skeleton, it will be proper to observe whether the bones belong to the same or different individuals, to the right or the left side of the body; and these questions may be determined in many cases by the mere inspection of fragments. The existence or non-existence of *fractures*, and the progress which may have been made towards ossific union, may also become an important subject of inquiry. In general the past existence of a fracture, is easily determined in an exhumed bone, by the appearance of a knot or ridge, or in some cases a thick deposit of bone where union has taken place badly. In a fractured bone which has united in a curved form, it will be observed, on making a section, that the shell is considerably thicker on that side which has had to bear the greatest weight or pressure. All these facts, trivial as they may appear, may in reality be material in a case of disputed identity; and unless carefully observed at the time, valuable evidence may be lost.

An English gentleman residing in India was charged with the murder of a native, *Meer Khan.* The evidence against the prisoner was of a two-fold character: 1, that which preceded death, and 2, that which followed it. With regard to the first, it will be only necessary to refer to it briefly. There was great discrepancy in the statements of the witnesses, as to the manner in which the deceased was alleged to have been destroyed. It was shown that the deceased had received a beating at the hands of the accused, but it was not proved that the man had died in consequence of the beating. There was no effusion of blood; there were no marks of violence of any kind upon the body before or after death, unless, indeed, we except a burning of the skin of the legs, which was alleged to have been produced by burnt paper or straw, but the evidence respecting this was anything but coherent and conclusive. Be that as it may, however, there was no evidence to prove that the alleged burning was the cause of the man's death.

Two of the men (natives) who said they carried the dead body to be buried at midnight, testified to the presence of marks of burning, but contradicted each other respecting the appearance of the legs; one swearing that they were covered with plaster, the other that the wounds and burns were not covered. The latter witness prevaricated, and, when asked how he knew that the legs were burnt, replied that he judged so from their being *white.*

The testimony respecting the degree and effects of the violence applied to he deceased during life being, then, so inconclusive, it was left to the jury to lecide whether a quantity of human bones produced were those of the leceased, as it was alleged by the witnesses for the prosecution, or whether hey belonged to the skeleton of some other person. According to the lepositions, they were found in the following manner. *Three months* after he burial, one of the witnesses who had assisted in burying the deceased, after ome search, discovered, as he supposed, the grave, on the verge of the bank f the river Damoodah. The body, it seems, had been buried pretty deeply n the sand, above the common water-mark, at the distance of sixty or eighty ards from the bed of the river, at a place which the waters had never reached, r could reach only on extraordinary occasions. The bones were uncovered, ut not removed, until five days afterwards. It does not seem to have been learly made out whether other bodies were ever interred in that spot or not, or was the grave properly identified as that of the deceased.

The bones were subsequently examined by Mr. Cheek, a medical officer ttached to the station of Bancoorah. He stated in his evidence that twelve f the vertebræ, six of the ribs, and the sacrum, were wanting; that the vhole of the bones found were clean and dry, and free from periosteum, igaments, and cartilage; that *one rib was broken,* and apparently had an sseous callus (new bone) formed upon and around the fractured ends. The witess gave it as his opinion that the fracture must have occurred at least seven or ight days before death; he had never heard of an instance of exhumed bones eing deprived of soft parts and ligaments by natural decomposition in three nonths. He should not expect the cartilages and ligaments to be separated rom the bones within a year of the interment; he considered it, therefore, xtremely improbable that these were the bones of the deceased, or of any erson who had died within three months from the time of examination.

From this evidence, as the reporter of the case remarks, several consideraions suggest themselves; as, for example, the identity of all the bones as those of one individual, the age of the person, the nature of the bony excrescence or callus found on the broken rib, the time necessary for the formation of new bone in order to settle the period at which the fracture took place, the time required for the total spontaneous destruction of the muscles, tendons, ligaments, and viscera; also the time required for the spontaneous separation of the sacrum from the other bones in a man of the age of fifty or sixty. Many of these points, important as they were, were altogether passed over. The witness gave it as his opinion, that they were the bones of a *male* subject; but of this, he said, he could not be quite certain as the sacrum was wanting. No opinion was asked or given as to the supposed *age* of the person to whom the bones belonged. Only one bone was produced in Court, viz., the broken rib, with the deposit of callus (new bone) at its extremity. From the state of this callus there could be no doubt, supposing the bone to have belonged to the deceased, that the *fracture* must have been produced about eight or ten days before death; therefore at some time previous to the violence employed by the prisoner.

The non-identity of the bones as those of the deceased, seems, however, to have been clearly established by the condition in which they were discovered. Even in a tropical climate the period that must elapse before the total destruction of the soft parts of the body in a grave, so that nothing but the bare bones shall remain, must be considerably greater than three months. In one instance, in which a body was exhumed four months after death, the soft parts were still present.

Another curious feature in the evidence was the separation of the sacrum from the bones of the pelvis. The junction of these bones by ligaments and fibro-cartilage is perhaps one of the strongest in the body. In the skeletons of the young these bones are rather difficult of separation; but in the old, in whom anchylosis in general takes place to a greater or less extent, the difficulty of separating them becomes incomparably greater. It may readily be conceived, then, that the entire separation of this bone by decomposition, would require, even in a hot climate, an extremely long period in a body interred in the ground—probably from three to ten years. Now, when we consider that the deceased had not been buried above three months, it is clear, both from the entire destruction of the soft parts, and the separation of the sacrum, that the bones discovered on the bank of the river, could not have belonged to the deceased, but must have been part of the skeleton of a person whose body had been buried in the spot many years before. There was, therefore, a complete failure of identity, and the accused was discharged.

Identity from Disease or Deformity.—Questions of identity in relation to skeletons may be in some cases solved by reference to certain special characters of the bones. They may have about them indications of disease; as rickets, softening of the bones, or syphilis. There may be, again, some personal peculiarities, such as the presence of supernumerary fingers or toes, which, if observed, may tend to throw some light upon the case.

A curious instance of this kind is mentioned by Orfila. In the year 1823, a soldier, of the name of *Bonino*, who had been residing in a small village in the neighbourhood of Montpellier, suddenly disappeared. It was some time afterwards reported, that he had been murdered by a girl with whom he had cohabited, and by a man of the name of Dimont, who was known to have been for some time her associate. It was only in the year 1826, after the lapse of more than two years, that the magistrates were first induced to direct an investigation of the case. A strict search was ordered, and the remains of the body, chiefly the bones, were found buried in the garden of Dimont, who had married the girl nine months after the disappearance of Bonino. It was of course essential to identify this skeleton as that of the deceased. It was well known that he had laboured under a singular personal deformity in having a sixth finger on the right hand, and a sixth toe on the left foot. The bones, which were nearly all perfect, were carefully removed and put together, when it was found that those belonging to the two smaller toes of the left foot were wanting; but the metatarsal bone of the fifth toe had a process on the outer side, with a small articulating surface, which might have formed a supernumerary joint. Still, however, this was considered insufficient to establish the point, and the attention of the examiners was then directed to the right hand. The fifth bone of the metacarpus was shorter and broader than the one belonging to the opposite hand, while its digital extremity was divided into two parts, of which one formed a smooth, rounded, articulating surface in the axis of the bone; while the other, which presented a more flattened articular surface, formed with it an angle of about 8°. On attempting to articulate the first phalanx of the little finger, it fitted exactly the first articular surface, and presented on the outer side a distinct groove, the oblique direction of which coincided with the direction of this second surface. This left no doubt of the nature of the peculiarity of structure; although the phalanges of the sixth finger could not be discovered. The left hand and the right foot were complete in all their parts. Other corroborating circumstances transpired with respect to the marks of violence on the body, and the two prisoners were tried, condemned, and executed. (For other cases see 'Ann. d'Hyg.' 1863. 2. p. 114.)

Deformities of the spine or limbs are easily observed, and form well-marked points of identity. Briand mentions the following case. In 1825 the brother of a man named Michel Guérin suddenly disappeared. A year afterwards an excavation was made in the cellar of the house where the two brothers had resided, and some human bones were discovered. Among other circumstances, the medical men to whom the examination of these bones was referred, remarked that the body of the fifth lumbar vertebra was depressed and thin as it is met with in rachitic individuals, that the pelvis was more contracted on the left than on the right side, that the tibia and fibula of each leg presented a remarkable curvature, greater, however, on the left than on the right side, so that the left leg was half an inch shorter than the right. There were certain peculiarities about the teeth of the lower jaw, the cuspidati forming a considerable projection in front of the incisors. These facts, together with other circumstances, established the identity of the bones, as being those of the individual who had been missing for a year. The bones of the skull in children may occasionally present appearances arising from natural causes, but which may simulate the effects of violence applied to the head. The following case of suspected child-murder was examined by Mr. Lord and myself in 1847. The dead body of a new-born child, wrapped in brown paper and a towel, was found in a pond. Mr. Lord examined it for the coroner's inquest. The head was much decomposed, and the scalp was extensively lacerated and destroyed over the parietal bones, which readily separated. The brain was reduced to a bloody pulp. The umbilical cord, which had not been tied, was cut obliquely at about six inches from the navel. The lungs, which were very crepitant, readily floated on water, and bore up the heart. The body was generally bloodless. The point of difficulty which the case presented, consisted in the presence of two apertures on one parietal bone. These apertures were small and rounded, and it was at first doubtful whether they had not been wilfully produced by some perforating instrument applied to the head. It was remarked that one aperture was situated near the temporal ridge, and in this situation the scalp was entire and uninjured. The other was situated in that part of the bone which corresponded to the lacerated portion of the scalp. It was ascertained that no violence had been used in the removal of the body from the water. The bone was macerated, and carefully examined by the aid of a lens. It was then perceived that the apertures were quite regular at the edges, which were remarkably thin, evidently passing into a membranous condition. The internal table was also deficient, so that, from the interior, the bone was bevelled off gradually from each aperture. This examination left no doubt that the holes in the bone were not due to any mechanical violence applied during life, but to deficient ossification. These spaces had been membranous, and the membrane destroyed by decomposition. The putrefaction of the scalp, and its separation, might have been accelerated by a bruised condition of these parts during a difficult labour.

It has already been stated that the bones which we are required to examine, may have undergone *calcination.* In several cases of murder which have occurred, an attempt has been made to dispose of the body by burning it. This method of disposing of a dead body is by no means unusual in cases of alleged child-murder and concealment of birth. There will be no great difficulty in giving an opinion whether a bone has or not undergone calcination. Its character is entirely altered. Its shape may be preserved, but if burnt in the open air, it will be white; if in a close fire, it will be black or ash-grey. The bone is brittle, easily pulverisable, and dissolves entirely in hydrochloric acid, leaving, if perfectly calcined, only some charcoal, but no animal matter.

In the case of the *Queen* v. *Varney* (Oxford Lent Assizes, 1837), it was proved that the woman had been pregnant, and subsequently delivered of a child. Its body had been burnt, and only a few remains of the bones of a human fœtus were found in the ashes of a grate. The prisoner was convicted of concealment of birth. In a case like this, in which an attempt had been made to destroy the body of a child by burning, it will, of course, be necessary to have good evidence that the bones are those of a *human fœtus* or child. A small fragment only of either end of any well-marked bone will suffice for identification. If the jaws be forthcoming, the alveolar cavities should be sought for, and the number and condition of the teeth noticed. The period of uterine life which the child had attained, may be thus in some instances determined. For two cases in which age and identity were thus determined, see 'Gazette des Hôpitaux,' April 26, 1850.

If the body has been burned to a complete ash or powder, it will then be difficult to identify the bones. Orfila was consulted in a case of this kind, where a woman had burnt a child in an oven, and its ashes had become mixed with those of wood. He suggested that on calcining the residue with potash, the ashes of a human fœtus might be known by their yielding cyanide of potassium, owing to the nitrogen which would remain in and about them. The ashes of wood do not yield the cyanide under similar circumstances. ('Ann. d'Hyg.' 1845, vol. 2. p. 129.) The conclusions drawn under such circumstances might, it appears to me, lead to a serious error:—the presence of a flannel dress, of an old hat, shoe, or any nitrogenous substance, would, on incineration, give rise to precisely similar results. When the *form* of a bone cannot be recognized, all that medical evidence can accomplish may be thus stated:—The detection of a large quantity of *phosphate of lime* in the ash would indicate that bones were present, and thus distinguish the ash of bone from the ashes of other substances. Still the bones might have belonged to an animal, and not to a human fœtus. There are no means of distinguishing the ash of human, from that of animal bone, or the ash of fœtal, from the ash of adult bones. In the case of the *Lemoines*, mother and daughter, tried before the French Courts in December 1859, the evidence went to show that the elder prisoner (the mother) burnt the body of a child of which her daughter had been secretly delivered.

Some bones of a child were recovered, and among others the frontal bone. The medical evidence was to the effect, that the bones were those of a child which had reached about the seventh or eighth month. Upon this corroboration, the jury convicted the elder prisoner, and the Court sentenced her to twenty years' imprisonment.

In a case of concealment of birth tried at the Guildford Summer Assizes, 1854 (*Reg.* v. *Berryman*), it was proved by medical evidence, that the prisoner had been recently delivered of a child, not less than seven months of uterine age. She said that she had burnt the body to conceal her shame, and had buried the remains in a garden. Some bones which had been calcined were there found buried in ashes; and after an examination of them, a medical man stated that they were the bones of a child nine months of age; but in comparing them with the skulls of nine months' children in Museum collections, it was admitted that the skull, of which the parts had been found and restored, was larger. This admission threw some doubt on the identity of the bones, and the prisoner was discharged.

In January 1863, a man named *Barton*, a fireman employed at a coal pit near Wigan, was missing. From the appearance of blood about the mouth of the steam furnace, and the discovery of a burned portion of the dress worn by the deceased, there was reason to believe that the man had been murdered and his body thrust into the furnace. Dr. Edwards, of Liverpool, examined the ashes of the furnace and found :—1. Portions of the occipital bone of the human skull; 2. Base of the skull and two fangs of teeth, a fang of incisor and a fang of molar; 3. Portions of the arches of the dorsal vertebræ; 4. A portion of the lumbar vertebræ; 5. A portion of the head, body, and joint of the humerus; and 6. A portion of the head and joint of the femur or thigh-bone. These bones had been heated to a high temperature, which had destroyed their internal structure, but the external form was well preserved. They were human bones. A chemical and microscopical examination of some of the clinkers showed that there was blood upon them, having the character of human blood. There was no doubt that these were the remains of the missing man. He was last seen alive at eight in the evening, and at four the following morning, nothing remained of him but the few bones above mentioned.

In the exhumation of remains, portions of *hair* may be found on or about the skull, or in the earth surrounding it. The hair should be separated by washing it first in water, and afterwards in a mixture of distilled water and diluted acetic acid. When dried on paper the colour will be observed, and this may be of some value in determining a question of identity. French medical jurists lay great stress upon the necessity for determining whether the hair has been artificially dyed or not. The common hair-dyes are compounds of lead, silver, or bismuth; and these metals, when the necessity arises, may be sought for and easily found by processes similar to those required for their detection as poisons when absorbed into the tissues. This will be a matter for future consideration.

CHAPTER 7.

CAUSES OF DEATH—SUDDEN DEATH—SYNCOPE, ASPHYXIA, COMA—PRESUMPTION OF DEATH—MEDICAL EVIDENCE OF PRIORITY OF DEATH IN CASES OF SEVERAL PERSONS PERISHING FROM A COMMON CAUSE—PRESUMPTION OF SURVIVORSHIP.

MEDICAL jurisprudence takes cognizance of all violent causes of death, and is only indirectly involved in those cases of natural death which simulate the effects of violence. Thus all causes which operate to produce death suddenly, as by syncope, asphyxia, or coma, especially demand the attention of a medical jurist. These may be either natural or violent; and the distinction between them is of importance, since the guilt or innocence of a person charged with crime may depend on a correct determination of the cause.

The continuance of life depends upon the proper and regulated action of the heart, the lungs, and the brain; and the interdependence of these organs is such that the arrest of the functions of one of them, is speedily followed by the arrest of the others. Hence they have been called the tripod of life. When the suspension of the motions of the heart is the primary cause of death, the person is said to die by syncope. The term asphyxia is applied to death which begins by the lungs; and coma to that which arises from a primary disturbance of the functions of the brain.

Syncope (συγκόπτω).—In order that the action of the heart should be maintained, it is necessary, first, that the blood supplied to it should be in sufficient quantity, and secondly that this blood should be of proper quality. In death from hæmorrhage we have an instance of deficiency, and in death from certain poisons, as well as diseases, an illustration of defect of blood. In ordinary syncope (fainting or swooning) there is simply a deficiency in the quantity of blood which passes through the heart, although there is no actual loss of this fluid from the circulation. Certain diseases which affect the muscular structure of the heart, as well as its membranous valves and blood-vessels, may also lead to a sudden arrest of its functions. These morbid conditions produce a mechanical impediment to the motions of the organ by which the blood is propelled, and death by syncope is the necessary result.

When death takes place by the heart, the right and left cavities of this organ are found to contain blood in the normal proportion in which that fluid is ordinarily circulated. This retention of blood in these cavities, arises from the sudden stoppage of the heart's contractions. Blood is found in the large veins (venæ cavæ), as well as in the arterial trunks. There is no congestion or accumulation of blood in the lungs or the brain.

Asphyxia (ἀ priv. and σφύξις pulse, signifying pulselessness).—This state is induced by any cause which arrests the function of respiration. The term apnœa (from ἀ priv. and πνέω I respire) is more appropriate; for the state of syncope might equally be called asphyxia. The various forms of death by suffocation, as in the obstruction of the air-passages from mechanical causes, in drowning, hanging, and strangulation, furnish illustrations of death commencing by the lungs, or asphyxia. The effect of cutting off air from the lungs is that the blood is not aërated, and it is therefore circulated in a state unfitted to support the nutrition of the heart and brain. It is necessarily distributed with the impurities derived from the waste of tissue, and thus acts as a poison to all the organs. It is incapable of sustaining nerve-force or muscular irritability. It stagnates in the capillary vessels of the lungs, produces a languid action of the heart by its circulation through the muscular structure of this organ, and it produces insensibility by its distribution through the blood-vessels of the brain. The lungs are essential to the circulation by purifying the blood. Death from asphyxia may be therefore regarded simply as death from *defect* of blood. The observations of the late Sir B. Brodie ('Lectures on Pathology,' 66) and others have clearly proved that in spite of the impurity of the blood, the heart will continue to act and the circulation to be maintained for two or three minutes or longer after respiration has entirely ceased. This may be proved by hanging or strangling an animal, and observing the condition of the heart. As the action of this organ continues after the animal has ceased to breathe, life is not actually extinct; and under favourable circumstances, it may be restored, so long as this action continues. Supposing that the suspension of respiration is complete, the action of the heart gradually slackens and finally stops. It is at this period of the complete arrest of the motions of the heart that asphyxia passes into death. Apnœa is determined by the time at which respiration is completely arrested. The circulation of the unaërated blood through the brain, appears to annihilate sensibility, so that no consciousness or feeling exists: the person is, to all appearance, dead. There are many diseases which operate fatally by arresting the functions of the lungs, and these may be regarded as furnishing the natural causes of asphyxia. The violent causes, including not only the ordinary modes of suffocation, but the effects of certain poisons, are not difficult to appreciate, provided a true history of the case can be obtained.

In death by the lungs, as the circulation of the blood is primarily arrested in these organs, the pulmonary artery, the right cavities of the heart, and the venæ cavæ are found gorged with blood. The pulmonary veins, the left cavities of the heart, and the aorta, are either empty or contain but little blood. In certain cases of asphyxia, the right cavities of the heart, as well as the left, have been found empty. When the access of air to the lungs is suddenly and completely cut off, the circulation of the blood is very speedily arrested; but supposing the occlusion of the air-passages to be partial or gradual, the circulation of the blood may continue for a time, and thus cause congestion of certain organs. Hence the appearances in asphyxia differ greatly. A mixed condition under the name of syncopal asphyxia has been described by some pathologists. In this, the cavities of the heart are found empty.

Coma.—Besides a due supply of aërated blood, the brain requires for the exercise of its functions a proper quantity of blood, so that either by the sudden withdrawal of this fluid, or by a distribution of impure blood, these are arrested. A person thus affected falls into a state of complete insensibility (coma), so that it is impossible to rouse him. The functions of the heart and lungs are not suddenly arrested under these circumstances. They appear to be less dependent on the brain than the brain is upon them; but this is rather a question of degree. A due supply of nervous force is required for the action of the muscles, whether of the heart or of the chest; and when this is withdrawn, the heart ceases to pulsate, and the respiratory muscles cease to act: circulation and respiration are thus arrested by the absence of innervation. This is sometimes described as death by paralysis of the heart and lungs. The blood is neither aërated nor circulated. Sudden death from apoplexy is an illustration of death by the brain. Coma may also be a result of the introduction of certain poisons into the blood, and of fractures of the skull leading to compression of the brain or destruction of its substance.

In death by the brain, the appearances observed consist chiefly in a congested state of the cerebral membranes and substance of the brain. As, before death, respiration is affected, the lungs are congested and blood accumulates in the cavities of the heart, more on the right than on the left side.

The appearances described as characteristic of the different modes of death by the heart, lungs, and brain, are liable to variation by reason of the intimate relation of the organs. Thus, there may be a mixed condition of syncope and asphyxia, or of asphyxia with cerebral congestion.

With regard to the interruption of the functions of the brain as a result of pressure by the effusion of blood or serum, it is to be observed that a very small quantity effused at the base or in the substance of the medulla oblongata, is sufficient to cause death; while generally speaking a larger quantity is required to be effused in the membranes, ventricles, or substance of the brain, in order to produce a fatal result. In cases of chronic hydrocephalus, in which the brain has resisted the pressure of a large accumulation of serum for many years, a slight and sudden increase in the quantity at any period of life may lead to coma and death by apoplexy. This condition may be mistaken for narcotic poisoning.

All causes of death, whether from disease or violence, are referable to an effect produced primarily on the heart, the lungs, or the brain; but, as it has been elsewhere stated, death does not take place until the action of the heart has entirely ceased. The arrest of the circulation produces an immediate impression upon the functions of the brain and lungs; while the lungs and brain are affected and can only affect each other indirectly through the medium of the circulation: hence, systemic death, or the death of the body, is resolvable into death by syncope or a failure of the action of the heart, and this depends in all cases either upon defect or deficiency of blood.

The natural causes of *sudden death* may be generally traced to some injury or impediment to the action of the heart, lungs, or brain. It would be foreign to the objects of this work to give a description of them. The violent causes are those which demand the especial attention of a medical jurist; they will be considered hereafter. In its relations to medicine and medical jurisprudence the subject of sudden death has been most fully treated by Herrich and Kopp ('Der plötzliche Tod aus inneren Ursachen,' Regensburg, 1848); as well as by M. Devergie ('Ann. d'Hyg.' 1838, 2, 145). To these works I must refer the reader for further information on the causes, as well as on the appearances met with in the bodies of persons dying suddenly from natural causes.

The violent causes of death, whether sudden or protracted, which chiefly require the skill of a medical jurist for their elucidation, are poisoning, wounds, and personal injuries, such as burns and scalds, as well as those forms of death which commence by the lungs, including drowning, hanging, strangulation, and suffocation. In nearly all cases, the body of the deceased is produced, and a medical opinion can be based upon a careful examination.

Presumption of Death.—Before proceeding to describe these violent causes of death in their order, it may be well in closing this part of our subject to state that the fact of death may be proved by presumptive, as well as by direct evidence. The death of any person once shown to have been alive, is a matter of fact to be determined by a jury; and when the body is not forthcoming, as the legal presumption is in favour of the continuance of life, the onus of proving the death, lies on the party who asserts it. (Best on 'Presumptions of Law and Fact.') When a person goes abroad and has not been heard of for a long time, the presumption of the continuance of life ceases at the expiration of seven years from the period at which he was last heard of. The same rule holds generally with respect to a person who has gone away from his usual place of resort, and of whom no account can be given, but the presumption does not extend to the *time* of his death, *i. e.* whether he died at the beginning or at the end of any particular period of the seven years. In the case of *Watson* v. *England*, which came before the Court of Chancery some years since, it was attempted to enforce as a presumption, that a female who had left her father's house in 1810, and had not been heard of for thirty-four years, was dead. No decision was come to, the Vice-Chancellor observing, from the great uncertainty of the evidence, that if he presumed her death, the woman might walk into Court and disprove all. In one case, according to Best, the Court of Queen's Bench said, that they could not assume judicially that a person alive in the year 1034 was not alive in 1827! (Op. cit. p. 190.) Without adopting this extreme legal view of possible longevity, it is obvious that Courts of law may be easily deceived if such presumptions are admitted too readily. In *Church* v. *Smith* (Exchequer, Dec. 1853), the question was whether plaintiff was then a married woman, or whether by reason of the long absence of her husband, his death might not be legally presumed, and that she was, therefore, a widow, and could sue in her own right. According to the statement of her counsel, she was married to a man who had deserted her fourteen years ago, and she had heard nothing of him during the last twelve years. An end was put to the case by the appearance, in the witness-box, of an aged man who turned out to be the missing husband. The plaintiff, therefore, not having the power to sue in her own right as a widow, was non-suited, the Chief Baron observing to the jury, that he should have directed them to presume that the husband was dead, if, as the counsel stated, it had been proved that he had not been heard of for twelve years; but after his appearance in Court, he could not ask them to presume a man to be dead who was actually living before their eyes.

In *Reg.* v. *Briggs* (Nov. 1856), a woman was deserted by her husband four months after marriage, and he had been absent from her seven years. The woman married again in her maiden name; and on an indictment for bigamy, it was contended in her favour that the husband had been absent for the period above mentioned, and the prisoner had no knowledge of his existence. She was convicted, but the conviction was quashed on appeal.

Great injustice would be done unless some rule were adopted regarding the disposition of the property of those who have been long absent, and not heard of for many years. In the case of *Davy* (Probate Court, 1858), it was proved that the testator was a master-mariner. He made his will on December 2, 1856, and sailed for Melbourne from Southampton in December of that year. He then made a voyage to Calcutta, where he arrived in October 1857, and in the following December, cleared from Calcutta for Port Louis in the Mauritius. His vessel never arrived at her destination, and nothing had been heard of her since that date. The correspondent of the owners of the vessel at the Mauritius, had from time to time reported her non-arrival. This was considered sufficient to establish a presumption of his death, although not more than two years had elapsed since his departure from England; and probate of the will was granted.

In *Green* v. *Green* (Vice-Chancellor's Court, July 1861), a question was raised whether a person who had not been heard of for upwards of eighteen years must be presumed to have died. The testator in the cause, who died in August 1838, by his will, dated in April 1838, gave an annuity of 30*l.* to his son, James Green, and upon the death of such son, the testator gave 750*l.* to the children of James Green, and if he should die without leaving children, then the testator gave such sum of 750*l.* to the brothers and sisters of James Green who should be living at his (James Green's) death. In September 1840, James Green left this country for New South Wales, and he had not been heard of since February 1, 1843, when he wrote a letter acknowledging the receipt of the last payment of the annuity of 30*l.* Edward Green, one of the brothers of James Green, died on January 25, 1846, and the question was, whether the absent James Green must be presumed to have died before or after his brother Edward Green. On the former presumption Edward Green's representatives would be entitled to a share of the 750*l.*; and on the latter presumption, they would not be so entitled. The bill was filed by one of the children of the testator, who was interested in the presumption that James Green had died after his brother Edward, and in that state of circumstances, the Vice-Chancellor ruled that the burden lay on the plaintiff to show that James was alive at the death of his brother Edward. As above stated, there was nothing to show that James Green had been heard of since February 1, 1843. A decree was made to the effect that James Green must be presumed to have died before Edward Green, and that the fund should be distributed upon that presumption.

A remarkable case was tried in the Court of Exchequer, Guildhall, in February 1862 (*Hiorns and Drew v.* The Railway Passengers' Insurance Company) which involved a question of the presumption of death from circumstantial evidence; but in which it was suggested that a grave fraud had been perpetrated by the parties concerned. The action was to recover from defendants, the sum of 250*l.*, on a policy of insurance on the life of one *F. D. Hiorns.* The alleged deceased, Hiorns, was a single man, æt. 26. He insured his life against accident, for the above-mentioned sum, on the 6th September, 1856; and on Saturday the 13th September, he went to Brighton by an evening train, taking a return ticket. He spent Sunday and Monday with his friends, and on the morning of the latter day (the 15th) he had a bath in the sea; in the evening he parted from his friends, at about seven o'clock, to go to his lodgings before returning to London, expressing his intention of taking a second bath before doing so. He was seen to go towards the sea, and from that time up to the date of the action he had not been seen alive. On the day that he was missing, a person discovered a suit of clothes lying on the top of the steps of a bathing machine, but no trace of the owner of them, could be discovered. The police took possession of the clothes, and upon searching the pockets a purse, containing a return-ticket, was found, and they were identified as belonging to Hiorns. Advertisements were issued, and every inquiry made to discover the missing man, but without avail. On the 30th of October, forty-five days after the disappearance of Hiorns from Brighton, the naked body of a man was washed up at Walton-on-the-Naze, on the Essex coast, about 150 or 160 miles from Brighton. The body, according to the opinion of some medical men, had been in the water some six or seven weeks, and it was, of course, very much decomposed, all traces of the features being destroyed. An inquest was held, at which the plaintiff, G. B. Hiorns, attended, giving evidence that the remains were, to the best of his belief, those of his brother. In consequence of the complete destruction of the features, according to the medical evidence, there was nothing whatever on which to base a proof of identity, and the jury found that it was the body of a person unknown. The defence to the action was: that the assured was still living and within reach of his friends, awaiting the receipt of the money from the Office. It seems that the alleged deceased had been a bankrupt in 1855; and in September 1856, he effected several policies of insurance in different Offices, and made his will, directing that the policies after his death should be realized and the money appropriated to the payment of his debts. The jury could not agree and were discharged without a verdict. As in this case the body of Hiorns was not found, there was no proof of death. The discovery of the clothes was only a circumstance from which a presumption might be raised either way. Considering that the man's life had been insured in this and other Offices for only one week, at the time of this mysterious disappearance, there was strong reason for suspicion.

It is obvious that such cases can be elucidated by medical evidence only when it is proved that the missing party was labouring under some serious disease, likely to prove fatal, for which he may have received medical advice; an opinion might then be required as to the degree to which the disease had advanced, and the probability of its causing death within a certain period.

No general rules can here be laid down; every case must rest upon the circumstances which accompany it.

A presumption of death may arise in a question of life-assurance, as when, for instance, the amount of a policy is made payable on the death of a person. He may have sailed in a ship which has not been heard of for many years; and from circumstances it may appear to have been overtaken by a storm in which other ships were lost. In such cases, payment is commonly made under a deed of indemnity. If the case be disputed, the presumption of death is left as a question for the jury. A verdict was returned for the plaintiffs in an action to recover a sum insured on the life of a Mr. Macleane, the evidence being that about November 28th, 1777, the insured sailed from the Cape in a small sloop, and was never heard of afterwards. Several vessels of stronger build sailed at the same time, and they encountered a violent storm in January 1778, in which it was supposed the sloop was lost. It is clear that unless a presumption of death were allowed in such cases, great njustice would be done to the representatives of persons who had insured their lives.

Priority of Death; Presumption of Survivorship.—Let us now take the case that several persons have perished together from some common cause; it may be material to determine which probably survived the other, since property may be claimed by different heirs through the several deceased persons. According to the civil law, when the parties who perished together were parent and child, the latter, if under the age of puberty, was presumed to have died first, but if above this age, the rule was reversed. In the case of husband and wife, the presumption was in favour of the survivorship of the husband. These presumptions were based on the assumption, that the party deemed to have survived, was, by his superior strength and vigour, likely to have struggled longest against the common death. The law of France is in ome measure based upon these provisions; but in England there is no decided ule on the subject. The question of which of two parties survived the ongest, is left to be determined by a jury or judge, according to the facts roved; such as the comparative age, strength, and danger to which they ere respectively exposed, and any other circumstance capable of proof which calculated to throw light upon the case. It has, however, happened on veral occasions, that there have been no such indicia, and the case has then enerally terminated by a compromise of the suit. There is a well-known istance which is referred to by most medico-legal writers, that of *General tanwix*, in which the General, with his second wife and a daughter by a rmer marriage, sailed in a vessel from Dublin to England. The ship with l on board was lost at sea, and no account of the manner of her perishing, as ever received. Several suits arose out of this accident. The maternal ncle of the daughter claimed the effects of the General, under the principles the civil law. This case was not decided: the suit was compromised on e recommendation of Lord Mansfield, who said he knew of no legal principle which he could decide it. In another case, Sir W. Wynne said, that in s judgment, the most rational presumption was that all died together; d that, therefore, none could transmit rights to another. In a third, where sband and wife were drowned, and a claim was made by the wife's relans, Sir J. Nicholl said he assumed that they both perished at the same ment; and he therefore granted administration to the representative of the sband, as the person in whom the property really vested at the time of the cease of both. He, however, expressly observed that in giving this judgnt, he was not deciding that the husband actually survived the wife.

In a more recent case, the property was vested in a wife, and she and r husband were drowned together without any of the circumstances being known. A claim was made by the husband's heirs, on the presumption that he was the survivor. Sir Herbert Jenner decided according to the principle that where a party dies possessed of property, the right to that property passes to his next of kin, unless it be shown to have passed to another by survivorship. Here the next of kin of the husband claimed the property which was vested in the wife, that claim must therefore be made out: it must be shown by him that the husband survived. In the absence of evidence, the parties must be presumed to have died at the same time, and the property therefore would remain where it was vested, unless there was evidence to show that it had been devested by survivorship.

Some years ago the following case was referred to me for a medical opinion:—whether it was likely, in the drowning of persons of different ages and sexes, in a confined apartment (the cabin of a vessel), that one should have survived the other. An officer in the army died in November 1819, leaving a wife and two daughters, bequeathing property among them. In 1823, the widow married again, and by this second marriage, she had several children: one of these, a son, survived. One of the daughters by the first marriage, Margaret, died in 1825, before majority, intestate, and leaving only as next of kin, her sister Johanna and her mother.

In 1834, the mother, her daughter Johanna, and her son, the last surviving child of the marriage between her and her second husband, were drowned on the coast of Norfolk, in the cabin of a sailing packet, while on their way to Scotland. The vessel filled with water from the sky-lights of the cabin during a storm. A few minutes before the catastrophe, all in the cabin were seen and spoken to, but not one of them was heard to speak or was seen alive after the cabin had become filled with water, which is said to have happened instantaneously. The deaths of the mother, daughter, and son, were supposed to have taken place at one and the same instant of time, at least it could not be proved by the direct testimony of any person that he saw any one of the three alive, or that he heard the cry or speech of any one of these three, after the death of the other or either of them. It may be mentioned that the mother was corpulent, and, by the ill-treatment of her husband, a broken-hearted woman, about forty-two years of age; the daughter was a stout healthy girl of about twenty, and the son about six years of age. Physical and constitutional strength were thus decidedly in favour of the survivorship of the daughter Johanna, who was in right of considerable funds at the time of her death, and she died intestate. A claim was made for her property by her nearest blood relation, her paternal uncle german. Her mother's second husband being still alive, claimed the property, as the representative of his wife, or his son, presuming that Johanna died before them, and that her property became vested in them. The opinion of Dr. Lushington being requested on this case, he stated that as to the question of survivorship, the presumption of law, in the absence of evidence to the contrary, was that the mother, daughter, and son all died at the same moment. The consequence would be, that none of the parties could transmit to the other. The paternal uncle would therefore be entitled to Johanna's property, on the principle already applied in so many cases, that the property being vested in her, those who desire to take it on a presumption, must produce evidence to show that she died before those persons through whom they set up a claim.

In this case there was not the least ground, medically speaking, for assuming that one of these persons survived the other. There was no evidence as to whether they were in different parts of the cabin, or whether the water reached one before the other; and in the absence of all facts of this kind, it would be an arbitrary assumption to assign survivorship to one.

It has been supposed that when males and females, and the young and ged, are placed in exactly similar circumstances with regard to impending anger, that a male or adult would survive: but on what principle can such n inference be drawn, when many inappreciable circumstances may have eally led to the prior death of the male adult? A case which was decided n America some years since, is calculated to show that a fixed arbitrary rinciple like that of the Roman law with regard to the death of husband and ife, must operate unjustly. (See case of Hugh Swinton Ball, p. 126.)

There is no doubt that the rules which influence English courts on these ccasions are based on equitable principles. A right to property once cquired is not permitted to be taken away upon a mere *presumption*; the ight may be averted by the production of satisfactory evidence, medical or eneral, but until this is brought forward, the property is considered to be ested in the holder and his heirs. Presumptions founded on age, sex, or the elative strength of the parties, are rather to be regarded as *assumptions* nadmissible, except when most strongly supported by direct evidence.

Under these circumstances it is scarcely necessary to refer to the rules hich have been laid down by some medico-legal writers, in reference to the riority of death among persons who perish by a common cause, as by fire, tarvation, suffocation, or cold. M. Devergie asserts that a female will survive male adult when both are equally exposed to suffocation from carbonic acid; ut a sufficient number of cases has not been observed to allow a fair nference on this point to be drawn; and very strong evidence would be equired by an English judge to satisfy him that such an opinion was niversally correct. As little can it be presumed that the young perish from uffocation before the old. These events are commonly treated as involving ircumstances which are from their nature unascertainable; and they are herefore dealt with according to fixed legal, and not according to medical ules. There are probably no two cases of death from a common cause, in hich all the circumstances will be alike; hence any general medical rule r assigning survivorship to one in preference to another, is inapplicable.

The case of *Underwood* v. *Wing*, involving a singular question of survivorhip, was brought before the Rolls' Court in July 1854. The opinions of r. Paget, Dr. Brinton, and myself were requested on one of the questions at sue in this case, namely, whether, under an apparently simultaneous death om drowning as a result of shipwreck, the husband survived the wife or the ife the husband for even the shortest period of time. The following is an tline of the facts:—

'Mr. Underwood, a man æt. 43, and his wife æt. 40, had a daughter aged 8 and two sons of the respective ages of 15 and 13. The husband and wife ere entitled to some small property, and being about to go to Australia, ith their children, they respectively made their wills, the one giving to the her absolutely, the whole of their respective properties, and by each such ill, they declared, that if the one to whom the same was given should *die the lifetime of the donor*, the property should go and be divided among eir three children on their attaining majority; and that in case all their id children died under 21, they then directed that their property should o to their mutual friend, Mr. Wing, the defendant. Mr. Underwood as a tall powerful man with a full and broad chest, of the height of six feet d one inch; he weighed about twelve stone. His wife was a little woman rather delicate habit, not exceeding five feet two inches in height, and eighing between eight and nine stone. They, together with their three ildren, sailed from London on October 13, 1853, by the ship 'Dalhousie,' d were wrecked off Beachy Head. Every person on board, with the excepn of one seaman named Read, perished. Read stated that the ship undered early in the morning of the 19th October, and went over on her beam-ends, and so floated for about twenty minutes, and then went down. Shortly after she so went over, Mr. Underwood, Mrs. Underwood, and their two boys were pulled out of the cabin window on to the side of the ship, Mr. Underwood having nothing on but his coat and trousers, Mrs. Underwood and the two boys being in their night-clothes. In the excitement of the moment, Mr. Underwood clasped his wife in his arms, and the boys clung to their mother: while in that position a heavy wave swept the four from the side of the ship into the sea, and as the sailor says, he never saw them afterwards, so he presumes they all went down together. The daughter was seen on the deck shortly afterwards, and she was lashed by him to a spar and set adrift on the sea. She is supposed to have died almost immediately.

It appeared from the evidence of Read, the only witness of the facts, that he saw the daughter alive in the sea, after the spar of timber had been cast adrift, and long after the father, mother, and sons had been swept overboard. Upon the question of survivorship, as to Mr. or Mrs. Underwood or two sons, a great body of evidence was adduced. Mr. Wotton and Mr. Hancock were examined, and they deposed that the deaths of all the four, *i.e.* the father and mother and two sons, had been simultaneous. Other surgeons had been examined, who gave it as their opinion that Underwood, who was a strong man, and a good swimmer, must have survived his wife and children in the waves, and that a man accustomed to swim, would have it in his power to preserve his breath longer than a woman or boys so young as his two sons. Others thought that whilst the woman and her sons died of asphyxia, the man, being strong and muscular, might have died before them from an attack of apoplexy.

The Master of the Rolls held that the weight of evidence as to Mrs. Underwood and the sons, was that they had been swept off the wreck at one and the same moment, and had perished simultaneously. The evidence of Read, who conducted himself with great courage and humanity upon the occasion, appeared to be worthy of credence, and he decided that as respected these four individuals, there was no survivorship. With respect to the daughter Catherine it was established, beyond a doubt, as he thought, that she had been seen alive after her parents and brothers had perished in the raging sea. Then in her instance there was no doubt she survived them, and the result must be that the property could not vest in the defendant, but in the plaintiff, who was the next of kin of Catherine Underwood. The event upon which the defendant was to take, never arose, and the claim of the plaintiff, as next of kin, was fully established.

The case was carried by appeal to the Lord Chancellor's Court, and subsequently to the House of Lords. The point referred for our consideration, was, not whether the daughter survived the parents (as all the children died under the age of 21), but whether, upon ordinary physiological principles, the husband must not have survived the wife, or the wife the husband, and in either case the defendant would have a well-founded claim to the property. The plaintiff, Underwood, a lady, and the next of kin of the husband, claimed the property on the ground that neither survived the other, and that both must have died together.

Our opinions were to the effect that the great strength of the husband, with the knowledge that he was a good swimmer, would justify a medical inference that he might probably have survived his wife, although only for a short period. Further, we were of opinion that, considering the nature of death by asphyxia, even if husband and wife were submerged at the same instant of time, there was no proof that they had really died at the same instant. Taking death to consist in the entire and permanent stoppage of the action of the heart, it could not be inferred of these two persons, differing as they did in age, sex, and strength, that the heart in each ceased to pulsate at the same fractional part of a second of time. Unless this physiological improbability, if not impossibility, were admitted, then it followed either that the husband survived the wife, or the wife the husband, and in either case, Wing, the defendant, would take the property under the will of either. The case was heard by the Lord Chancellor (Cranworth), and two of the Common Law Judges; and in February 1855, the Lord Chancellor delivered the following judgment:—

The Master of the Rolls held, that as the only title of the defendant rested upon a survivorship, it was incumbent upon him to make out his case. No such case had been made out, and therefore the plaintiff, as representing the next of kin, was entitled to the property. His Honour was also reported to have stated it to be his opinion that the evidence had the legal effect of proving that Mr. and Mrs. Underwood died at the same time. In this latter opinion the judges differed from the Master of the Rolls, but agreed with him on the main point, that the defendant had failed to make out his title. His Lordship in now giving judgment said, that he had had a conversation with the Master of the Rolls since the opinion of the judges had been given, and his Honour had stated that he did not mean, by any expressions he might have used, to declare it to be his opinion that Mr. and Mrs. Underwood died at the same time. All that he meant was, that in the absence of any positive evidence on the point, the property must go in the same way as if they had actually expired at the same moment. Without doubt it was almost impossible that two human beings could die at the same moment. Time, like space, was divisible into infinitesimal parts, and one of them might be considered as having died a millionth part of a second before the other. The real point in the case, however, was that it was not known, and could not be ascertained, which of the two, the husband or the wife, was the survivor. The first and simple view of the case was, that a lady disposed of her property by will to a particular person in the event of her husband dying in her ifetime. Now, in the absence of any proof that the contingency upon which the gift depended had taken place, the property must be considered as undisposed of, and the appeal would, as a matter of course, have been dismissed. An ingenious argument had, however, been made use of for the defendant, o the effect that, as there was a manifest intention in the will of Mrs. Underwood to dispose of her property in the event of her surviving her usband, the onus of proving that she did not survive him lay upon the arties disputing the disposition, and a great number of cases had been cited n support of this view. His Lordship then analyzed the cases, and stated it o be his opinion that they did not affect the present case, and he therefore ame to the conclusion that the decision of the Master of the Rolls was orrect. The appeal must be dismissed, but, under the peculiar circumtances of the case, without costs. Litigation did not stop here. The case as carried by appeal to the House of Lords, and in February 1860, six ears after the commencement of the suit, a final judgment was given conrming the decree of the Master of the Rolls and of Lord Cranworth, the hen Lord Chancellor (Campbell) dissenting from this decision.

The remarks made by Mr. Best, although published some years before the ccurrence of this singular case, embrace the whole subject by anticipation. e says, 'The true conclusion seems to be, that the law of England recognizes o *artificial* presumption in cases of this nature; but leaves the real or suposed superior strength of the parties perishing by a common calamity to its tural weight, as a *circumstance* proper to be taken into consideration by a ry or judge called on to determine the question of survivorship, but which *rcumstance* standing alone, is insufficient to shift the burden of proof. If, erefore, the party who, by laying claim to property on the ground of the survivorship of one individual over another, takes upon himself the onus of proving *that* survivorship, has no further evidence than the assumption that, from age or sex, one party struggled longer against their common death than his companion, it seems that no decree would have been made in favour of the claim. But, on the other hand, it is not quite correct to say that the law *presumes* both to have perished at the same moment. This would be to establish an artificial presumption against manifest probability, although the practical consequence is in many cases the same; because if the party on whom the onus lies, cannot show affirmatively which died first, the question will necessarily be treated by the tribunal as a thing from its nature unascertainable, and that for all that appears to the contrary, both died at the same moment.' (Op. cit. 201).

In reference to the case of Underwood *v.* Wing, it is obvious that the difficulty was created by the legal rule which threw the onus of proof on the claimant under the two wills. The case for the next of kin, who was not mentioned in the will, was that the husband and wife died at the same instant of time; but this was a physiological impossibility; and had the proof of this been thrown upon the plaintiff the case must have failed. The contention of the defendant was that the testator and testatrix could not have died at the same instant. This negative proposition could not, of course, be proved by direct evidence; it became simply a medical inference: but when the law declares that in the absence of evidence the property shall go in the same way as if the parties had actually expired at the same instant, *i. e.* as if they had died intestate, this is deciding such questions by a rule which is as arbitrary in its operation, as that of the Code Napoleon. In Underwood *v.* Wing this rule of law practically affirmed that an event took place which was physiologically impossible, and upon that event the wills of husband and wife were set aside, and the property was handed to one whose name was intentionally excluded from the wills of both.

Hugh Swinton Ball, with his wife and adopted daughter, was lost on board the steamer 'Pulaske,' on the coast of America, on June 14, 1838. By his will Mr. Ball bequeathed his property to his wife, and a claim was made by her heirs on the ground that she had survived her husband. It seems that an explosion took place on board the steamer at eleven o'clock at night, and that husband and wife were in different parts of the vessel, and thus separated from each other. Mr. Ball was not seen after the explosion, and, although he perished with many others, the precise time at which he died, could not be determined. Mrs. Ball was seen after the explosion, rushing in a terrified manner about the deck, calling for her husband with the most piercing cries, but no reply was made. She was soon afterwards missed, the promenade deck, to which she had retreated, having been submerged with herself and all who were on it. Chancellor Johnson, before whom the case was argued, said that it was a case to be decided by testimony, and as the right on the part of Mrs. Ball was derivative, the burden was on the plaintiffs to prove that she was the survivor. The evidence regarding the non-appearance of Mr. Ball, when, had he been living, there was sufficient time for him to have shown himself, with others, on deck, and to have made an effort to join his wife, was considered by the Chancellor to be conclusive of his death at the time that the wife was seen and recognized by many who knew her. On these considerations he decided in favour of the plaintiffs, that the wife survived the husband, and, therefore, succeeded to his estate. On appeal, in February, 1840, this decision was confirmed. ('American Journal of Med. Sci.' July 1845.)

This case is peculiar in the fact that the wife alone was seen living, and the nature of the accident was such as to render it probable that the husband had perished in the explosion. The counsel for the defendants ingeniously argued that as the death of the wife could be fixed, while that of the husband could not be fixed, it was fair to presume that she died first, but this argument failed to satisfy the court. The plaintiffs were not required to prove when the husband really died: they established enough to render it probable that the wife was really the survivor.

The following cases, one of which was tried in England and the other in Scotland, arose out of the fate of the expedition to the Polar seas, undertaken by Sir John Franklin in the year 1845. The first is that of *Ommaney* v. *Stillwell*, Rolls Court, November, 1856. His Honour, in giving judgment, said that, although there was no point of law in it, it was one of great difficulty to decide upon, from the paucity and singular nature of the evidence adduced. The sole question in the case was whether a father or son, *i.e.* James or Edward Couch, died first. James, the father, died in January, 1850. Of this there was no dispute. Edward, the son, went as mate on board Sir John Franklin's ship 'Erebus' on the Arctic Expedition in August, 1845. The fact to be determined, was whether he was alive or dead, and, if dead, whether he predeceased his father or not. The only evidence on this point, was to be found in the statement of Dr. Rae upon the probable fate of Franklin and his crew. Dr. Rae stated that he discovered the remains of a number of persons, supposed to be part of the 133 persons who joined in Sir John Franklin's expedition, and in 1854 he was informed by some Esquimaux that in April or May, 1850, they saw a party of about thirty white men dragging a boat along, their ship being crushed up in the ice. Of these men, all were pulling or pushing at the boat but one, who appeared to be their leader, and was supposed by Dr. Rae to be Sir John Franklin. The Esquimaux further added that they saw the white men kill some birds which never visited that region before the month of May. Now, if this story if the Esquimaux could be relied upon, and it could in any way be shown hat Edward Couch was among those persons whose remains Dr. Rae had dis-overed, there would be some kind of evidence, at any rate, to show that Edward Couch, being alive in May, 1850, survived his father, James Couch, who died in January in that year. But there was nothing whatever to show hat Edward Couch was one of these persons, or anything whatever that ould satisfy his mind that Edward Couch was among these then survivors of ir John Franklin's crew. One of the Chief Clerks of the Court had, how-ver, decided in favour of the son having survived the father, and, as it was ust as impossible to say whether he did so survive or not, the Court, for the urpose of avoiding further litigation, so far as lay in its power, would confirm he Chief Clerk's report. Decree accordingly.

The second case came before the Court of Session in Scotland in 1857. he question at issue, was whether a naval officer who went out with the ranklin expedition was dead; and, if so, when must he be held to have died. he late *Adam Fairholme*, who died in May, 1853, left his whole pro-erty to his nephew, James Walter Fairholme, lieutenant in the Royal Navy, ho sailed from Northfleet, on board the 'Erebus,' for the North Seas, in May, 345, and had not since been heard of. George Fairholme, another nephew, d instituted an action to have it found, under the destination of a codicil, at he was entitled to the whole of the testator's personal estate, valued at ,509*l*. This was opposed by other relatives, whose interests depended on hether or not James Walter survived his father. Proof by commission as taken with the view of legally establishing the questions raised in the se, and among those examined were Dr. Rae, Sir John Richardson, James urgreave, chief factor in the service of the Hudson's Bay Company, ptain Penney, and others. Dr. Rae expressed his belief that those per-ns who were reported to have been seen in the spring of 1850, must have died in the May of that year, and these he believed to have been the last survivors of Franklin's party. James Hargreave thought that some of the party might have survived a single winter after they had been seen by the Esquimaux in 1850, but certainly not longer. Sir John Richardson said: 'That if any of the party reached the country where they were said to have been seen at the end of the winter of 1849-50, it was impossible for them to survive a single year with any means they could have at their disposal.' Captain Penney remarked: 'I do not think that any of the party could have survived 1852; they must either have perished of hunger, or from the hostile attacks of the natives.' The Lord Ordinary (Mackenzie) reported the whole circumstances of the case to the Inner House, expressing his own opinion that there was thus strong presumptive evidence that Lieutenant Fairholme perished together with his companions some time prior to the end of 1852, and consequently that he predeceased his uncle, the testator, who died in May, 1853. His Lordship thought that in these circumstances the pursuer, George Fairholme, was entitled to a decree in his favour, but qualified by this condition, that before payment, he should grant a bond with sufficient security to warrant the defender against all hazard from any claim to the money decerned for, by Lieutenant Fairholme, or others in his right.

It would seem from an old case, *Broughton* v. *Randall* ('Croke's Elizabeth,' 503), that provided there be some direct evidence, a very small amount of proof is required for survivorship. A father and son were seised as joint tenants and to the heirs of the son. Both father and son were hanged at the same time, in one cart; but because the son, as deposed to by some of the witnesses, survived, as appeared by the shaking of his legs and probably some other tokens, the wife was held entitled to her dower! (Best, op. cit., 194.)

There has been much ingenious discussion as to the survivorship of the mother or child, when both die during delivery, and nothing is known respecting their deaths. So far as I am aware this question has only occurred once in an old case, quoted by Dr. Beck; and then some local German court arbitrarily decided that the child survived the mother, basing its decision, according to Valentin, upon the grounds—1. that the mother was exhausted by the labour, and 2. that the infant would not have died, until deprived by the death of the mother of its nourishment. Now it is quite possible that the child might have died soon after its birth, and the mother have survived: at any rate the medical reasons for this view are just as good and just as forcible as those against it, and the only equitable mode of dealing with such cases, when a legal question of a right to property is dependent on the decision, is to treat them according to the principles followed in contested survivorship. Those who would benefit by the presumption that the child survived the mother should be required to adduce satisfactory proofs.

In some cases of presumed survivorship medical evidence may be of service,—as where two persons are found dead from wounds affecting different parts, and these wounds are of different degrees of severity,—or where two are found dead from any cause, and the body of the one is cold and rigid, while that of the other is warm and pliant: here we have medical facts which may serve to guide the court, and enable it to come to a correct decision.

In one case, where husband and wife were found dead, both severely wounded and the bodies burnt, Dr. Ollivier remarked that the burns on the body of the wife had the characters of those which are produced during life, while those on the body of the husband were exactly like burns which are caused after death. He thence inferred, as they were exposed to the same cause of burning, that the wife survived the husband; for he considered that all signs of vitality must have ceased in him before the fire could have reached his body.

POISONING.

CHAPTER 8.

DEFINITION OF THE TERM POISON—DEADLY POISONS—MECHANICAL IRRITANTS—INFLUENCE OF HABIT AND IDIOSYNCRASY—CLASSIFICATION—SPECIAL CHARACTERS OF IRRITANT, CORROSIVE, AND NEUROTIC POISONS.

Definition.—A Poison is commonly defined to be a substance, which, when administered or taken *in small quantity*, is capable of acting deleteriously on the body: in popular language, this term is applied only to those substances which destroy life in small doses. This popular view of the nature of a poison is too restricted for the purposes of medical jurisprudence. It would obviously exclude numerous compounds, the poisonous properties of which cannot be disputed—as, for example, the salts of copper, tin, zinc, lead, and antimony; these, generally speaking, act as poisons only when administered in *large* doses. Some substances, such as nitre, have not been observed to have a noxious action except when taken in large quantity, while arsenic acts as a poison in a small dose; but in a medico-legal view, whether a man dies from the effects of an ounce of nitre, or two grains of arsenic, the responsibility of the person who criminally administers the substance, is the same. Each may be regarded as a poison, differing from the other only in its degree of activity, and in its mode of operation. The result is the same; death is caused by the substance taken, and the *quantity* required to destroy life, even if it could be always accurately determined, cannot enable us to istinguish a poisonous from a non-poisonous substance. If, then, a medical witness be asked 'What is a poison?' he must beware of adopting this popular efinition, or of confining the term poison to a substance which is capable of perating as such in a small dose taken at once.

In legal medicine, it is difficult to give such a definition of a poison as hall be entirely free from objection. Perhaps the most comprehensive hich can be suggested is this:—'A poison is a substance which, when bsorbed into the blood, is capable of seriously affecting health or of estroying life.' There are various channels by which poisons enter the ood: some are in the form of gases or vapours: these operate rapidly hrough the lungs; others are liquid or solid, and these may reach the blood ther through the skin or through a wound: but more commonly through e lining membrane of the stomach or bowels, as when they are taken or dministered in the ordinary manner. The latter chiefly give rise to medico-gal investigations. Some substances act as poisons, by any one of these annels: thus arsenic is a poison whether it enters the blood through the ngs, the skin, or the stomach and bowels: but such poisons as those of the per, of rabies, and of glanders, appear to affect the body only through a ound in the skin. When introduced into the stomach, these animal poisons ve been found to be inert. In adopting the above definition of a poison in medical sense, it is proper to remark that there are some substances which are regarded as poisons, although absorption into the blood does not appear to be necessary to their action. The mineral acids and alkalies belong to this class of bodies. They are corrosive poisons: they operate injuriously by causing the destruction of living parts; and whether applied to the skin, the stomach, or (in the form of vapour) to the air-cells of the lungs, they destroy life by the local changes to which they give rise, and the inflammation which is a consequence of their action.

It is not easy to define the boundary between a medicine and a poison. It is usually considered that a medicine in a large dose is a poison, and a poison in a small dose is a medicine; but a medicine such as tartarized antimony may be easily converted into a poison, by giving it in small doses at short intervals, either under states of the body not adapted to receive it, or in cases in which it exerts an injuriously depressing effect. Some deaths have been lately occasioned by this wilful misuse of antimony in doses which might be described as *medicinal*, although in the cases referred to, no other intention could have existed, in the secret administration of this substance, than that of destroying life. A person may die either from a large dose of a substance given at once, or from a number of small doses given at such intervals that the system cannot recover from the effects of one before another is administered. This remark applies to a great number of medicines which are not commonly included in a list of poisons.

In reference to the *medical* definition of a poison, it is necessary to observe that the law does not regard the manner in which the substance administered acts. If it be capable of destroying life or of injuring health, it is of little importance, so far as the responsibility of a prisoner is concerned, whether its action on the body is of a mechanical or chemical nature, and whether it operates fatally by absorption into the blood or not. Thus a substance which simply acts mechanically on the stomach or bowels may, if wilfully administered with intent to injure, involve a person in a criminal charge, as much as if he had administered arsenic or any of the ordinary poisons. It is, then, necessary that we should consider what the law strictly means by the act of poisoning. If the substance criminally administered, destroys life, whatever may be its nature or mode of operation, the accused is tried on a charge of murder or manslaughter, and the duty of a medical witness consists in showing that the substance taken was the certain cause of death. If, however, death be not the consequence, then the accused may be tried for the attempt to murder by poison (24 & 25 Vict. c. 100, s. 11, Aug. 1861). The words of this statute are general, and embrace all kinds of substances, whether they are popularly or professionally regarded as poisons or not. Thus it is laid down that—

'Whosoever shall administer, or cause to be administered to or taken by any person, any poison, or *other destructive thing*, with intent to commit murder, shall be guilty of felony.'

Whether the administering be followed by any bodily injury or not, the act is still a felony, provided the *intent* has been to commit murder. The attempt to administer or the attempt to cause to be administered to, or to be taken by any person, any poison or *other destructive thing*, with the like intent, although no bodily injury be effected, is also a felony (s. 14). If any doubt formerly existed whether the *external* application of poisons, *e.g.* by wounds or ulcerated surfaces, would be included in the words 'administering or taking,' they are now entirely removed by the Criminal Law Consolidation Act (Aug. 1861). The 22nd section specially applies to such an offence, and the 15th section provides that 'Whosoever shall, by any means other than those specified in any of the preceding sections of this Act, attempt to commit murder, shall be guilty of felony.' Mr. Greaves justly remarks, with regard to this important addition to the statute law, that 'the malicious may now rest satisfied that every attempt to murder which their perverted ingenuity may devise, or their fiendish malignity suggest, will fall within some clause of this Act, and may be visited with penal servitude for life.' ('Notes on Crim. Law Consolidation,' p. 49.) Under sect. 22 of this statute, in reference to attempted poisoning, some offences are comprised, which formerly escaped punishment: 'Whosoever shall unlawfully apply or administer to, or cause to be taken by, or attempt to apply or administer to, or attempt to cause to be administered to or taken by any person, any chloroform, laudanum, or other stupefying or overpowering drug, matter, or thing, with intent, in any of such cases, thereby to enable himself or any other person to commit, or with intent, &c. to assist any other person in committing any indictable offence, shall be guilty of felony.' A case under this section of the new statute was referred to me in September 1863. A medical gentleman was charged with 'attempting to cause to be administered' to an infant, a poisonous dose of laudanum. It was stated by a woman who nursed the child that the accused delivered to her two bottles containing a brown liquid, labelled 'one teaspoonful every three hours,' and directed her to give it to the child. None was given. Some months after the death of the child from natural causes, this charge was raised, and the bottles, still full of liquid, were produced as evidence against the accused. On analysis I found that the prescribed dose contained about five minims of laudanum, or nearly one half-grain of opium—a dose likely to prove fatal to an infant only a month old. Assuming the statement of the nurse who made the charge to be true, the only inference to be drawn from the prescription of such a dose for an infant by a medical man, would be that he intended to destroy the life of the child. The charge fell to the ground, as clear proof was given that the woman who made it was not to be believed on her oath, and that it had originated in a desire to xtort money.

Poison is not always administered with intent to murder. On many ccasions it has been mixed with food, and thus administered with a view o injure or annoy a person. Cantharides have been thus frequently given, nd in one instance (Nov. 1859) eight members of a family suffered from evere symptoms of poisoning by reason of the wanton administration of this rug. In April 1860, several members of a family suffered from severe ickness, as a result of tobacco having been put into water contained in a eakettle; and tartar emetic has been in some cases dissolved in beer or other quids as a mere frolic, without any proved or probable intention on the art of the offender to destroy life. The case of *M'Mullen* (Liverpool utumn Assizes, 1856), revealed an extensive system of poisoning in the orthern counties, in which tartar emetic was the substance employed. his drug, mixed with cream of tartar, was openly sold by druggists under he name of 'quietness powders,' and the evidence established that women ave these powders to their husbands with a view to cure them of habits of runkenness. Hitherto, when the intent to murder was not proved, the ffender has escaped, although great bodily injury may have been done y his wanton or malicious act. Sections 23, 24, and 25 of the Consolidaon Act, c. 100, provide for this omission:—

'23. Whosoever shall unlawfully and maliciously administer to, or cause be administered to or taken by any other person, any poison or *other estructive* or *noxious thing*, so as thereby to endanger the life of such person, r so as thereby to inflict upon such person any grievous bodily harm, shall e guilty of felony.'

'24. Whosoever shall unlawfully and maliciously administer to, or cause be administered to or taken by any other person, any poison or other destructive or noxious thing, with intent to injure, aggrieve, or annoy such person, shall be guilty of a misdemeanor.'

'25. If, upon the trial of any person charged with the felony above mentioned, the jury shall not be satisfied that such person is guilty thereof, but shall be satisfied that he is guilty of the misdemeanor above mentioned, then and in every such case the jury may acquit the accused of such felony, and find him guilty of such misdemeanor.'

It will be perceived that the words of the statute leave the question 'What is a poison?' to depend upon the medical evidence adduced: and in order to include all substances of an injurious nature, although they may not be strictly speaking poisons, the words '*destructive* or *noxious thing*' are employed. Hence, on these occasions, a medical witness must be prepared to prove that the substance was either a poison or a destructive or noxious thing. In a trial which took place at the Essex Lent Assizes, 1850 (*Reg.* v. *Hayward*), a woman was charged with administering *white precipitate* to her husband with intent to kill. She was acquitted on the ground that there was no evidence to show that white precipitate was either a poison or a destructive thing. It is, however, placed beyond doubt that this substance is not only capable of producing all the effects of an irritant poison, but of destroying human life; hence, this acquittal was based on a pure mistake. *White hellebore*, *Lobelia inflata*, and *Oil of turpentine* have been erroneously pronounced not to be poisons under similar circumstances; in fact, when this question is raised, unless the medical evidence received by a Court, be very closely investigated, great mistakes may arise, owing perhaps to want of experience or want of reflection on the part of those to whom the question is put.

The quantity of a poisonous substance found in an article of food, or in a dead body, does not affect the culpability of a person indicted for administering it. In the case of *Hartley* (C. C. C. May 12, 1850), in which an attempt was made to administer sulphuric acid mixed with coffee, Cresswell J. stated—if poison be administered with intent to murder, it is not necessary there should be enough in the article administered to cause death. If any poison be there, and the intent be proved, the crime of attempting to administer poison is complete. Erle J. ruled to the same effect, in reference to the discovery of a small quantity of arsenic in a dead body, in *Reg.* v. *Bacon* (Lincoln Summer Assizes, 1857). In *Reg.* v. *Southgate* (Chelmsford Lent Assizes), Parke B. said, in reply to an objection taken, it was quite immaterial to define or prove in what vehicle a poison was given, or whether it was administered in a solid or liquid state.

This question, 'What is a poison?' may present itself under another aspect. In *The Queen* v. *Cluderay* (Exchequer Chamber, January 19, 1849), the prisoner was indicted for administering poison with intent to murder. He was proved to have administered to a child nine weeks old, two berries in the husk, of *Cocculus Indicus*, and the berries passed through the body of the child without doing any injury. It was submitted for the prisoner, that being in the husk, they could not be considered a poison. The point was reserved by Williams J., who tried the case at York. It was now contended for the prisoner, that although the kernel of this nut was poisonous, still having been given in the husk, which was hard of digestion, it could not be considered an administering of poison within the statute. The Chief Justice said the Court was of opinion that, when a man administered something that was poison with intent to murder, but in such a way that it did not act, he was guilty. Conviction affirmed. This is the only reasonable view to take of such an objection. The seed contains the poison, but the husk is inert: nevertheless the berry as a whole must be regarded as a poison.

Deadly Poison.—The term 'deadly' can only be applied with propriety to those poisons which may prove speedily fatal in small doses, *e. g.* prussic acid, arsenic, strychnia, aconitina, and nicotina; and although it has been used in indictments in reference to such substances as blue or green vitriol, and common sal volatile, this has arisen from an unnecessarily strict adherence to old legal forms. In a case (*Reg.* v. *Haydon*, Somerset Spring Assizes, 1845), in which 'spirit of hartshorn' was thus described as a 'deadly poison,' and an objection was taken to the validity of the indictment, the learned judge (Erle J.) held that the word *deadly* was not essential; it was mere surplusage ('Law Times,' April 12, 1845).

Mechanical Irritants.—The substance administered may not be a poison in the medical signification of the term, and it may not be popularly considered as such; yet, when taken, it may be noxious to health or destructive to life. We have examples of substances of this description in iron-filings, powdered glass, sponge, pins and needles, and such like bodies, which have been administered with the wilful design of injuring, and have on various occasions given rise to criminal charges. In cases of this kind, the legal guilt of a prisoner may often depend on the meaning assigned by a medical witness to the words *destructive thing*. Thus, to take an example, liquid mercury might be poured down the throat of an infant, with the deliberate intention to destroy it. A question of a purely medical nature will then arise whether mercury be a 'destructive thing' or not; and the conviction of a prisoner will probably depend on the answer. Should a difference of opinion exist, an occurrence by no means unusual in medical evidence, the prisoner will, according to the humane principle of our law, receive the benefit of the doubt.

Influence of Habit on Poisons.—Habit, it is well known, diminishes the effects of certain poisons:—thus it is that opium, when frequently taken by a person, loses its effect for a time, and requires to be administered in a much arger dose. Indeed, confirmed opium-eaters have been enabled to take at nce, a quantity of the drug which would have infallibly killed them, had hey commenced with it in the first instance. Even infants and children, who are well known to be especially susceptible of the effects of opium, and re liable to be poisoned by small doses, may, by the influence of habit, be rought to take the drug in very large quantities. This is well illustrated y a statement made by Mr. Grainger, in the 'Report of the Children's mployment Commission.' It appears that the system of drugging children ith opium in the factory districts, commences as soon after birth as possible; nd the dose is gradually increased until the child takes from fifteen to venty drops of laudanum at once! This has the effect of throwing it into a thargic stupor. Healthy children of the same age would be killed by a dose five drops. The same influence of habit is manifested more or less in the e of tobacco, alcohol, ether, chloroform, morphia, strychnia, and other kaloids. Dr. Christison has remarked that this influence is chiefly confined poisons derived from the organic kingdom: it is so limited with regard to neral substances that it can scarcely be said to exist. The stories related of e arsenic-eaters of Styria, and the corrosive sublimate-eaters of Turkey, are erefore to be received with great distrust. There is no satisfactory evidence at any human being has ever accustomed himself, by habit, to take these bstances daily in doses that would prove poisonous to the generality of ults. M. Flandin states that he gave to dogs doses of arsenic in powder, nmencing with 1-65th of a grain mixed with their food; and that in nine nths, by progressive increase, they bore doses of upwards of fifteen grains arsenious acid in powder in twenty-four hours, without becoming affected appetite or health! ('Traité des Poisons,' vol. 1, p. 737.) This is contrary to all experience in the medicinal use of arsenic in the human subject; for, as it will be seen hereafter, a slight increase of a medicinal dose has often been attended with such alarming symptoms, as to render a discontinuance of the medicine absolutely necessary to the safety of the person. The most singular part of M. Flandin's statement, is that the arsenic thus given, appears to have remained in the body of the animal without causing injury! Thus he states that he examined the urine of the animals while living, without detecting appreciable traces of arsenic. The arsenic must, however, have undergone some rapid and extraordinary metamorphosis, for, in killing the animals on the third day, after the last dose had been given, none could be detected in their viscera, their flesh, or their bones! Such a state of things is inconsistent with all that has been hitherto acquired by experience regarding the operation of this or other poisons. Further observations are required before it can be admitted that dogs by habit can swallow fifteen grains of arsenic at a dose without the production of symptoms of poisoning; and at the same time no trace of the poison be detected in the urine while the animal is living, or in the body three days after its death.

In reference to the Styrian practice of arsenic-eating, Dr. Roscoe has published a case in which, according to information supplied to him, a Styrian took in one day $4\frac{1}{2}$ grains of white arsenic, and on the day following, $5\frac{1}{2}$ grains, crushing the mineral between his teeth and swallowing it. The day after he had swallowed the second dose, the man left the place in his usual health, and there is no further record of him. Such a case as this admits of no explanation on English experience. *Habit* appears to have so little influence on this substance under the most careful medicinal use in this country, that I believe no medical practitioner has ever succeeded in causing a patient to take two grains at a dose (the smallest quantity yet known to have destroyed life). Mr. Hunt, who has perhaps more extensively employed arsenic than other practitioners, fixes the maximum dose at one grain (two drachms of Fowler's solution). In Dr. Roscoe's informant's case, the man swallowed, in two doses, on two successive days, a quantity of arsenic equivalent to *two ounces and a half* of Fowler's mineral solution! *i. e.* sufficient to kill five adults. There is, however, a difficulty in assigning the alleged tolerance of this poison merely to *habit*. Dr. Roscoe quotes from Dr. Schäfer, 'a most important case of administration of no less than 555 grains of arsenic to a horse in twenty-three days, without any evil effects being produced.' It is not stated that the animal began to take arsenic in early life; and habit could have had but little influence in three weeks on the large quantity here given, even admitting that small doses were given at first, and that these were gradually increased. As no evil effects were produced, the only inference is, that by some speciality of organisation, arsenic was not a poison to this animal. There are on record several instances of human beings having recovered from very large doses.

Dr. Roscoe's pamphlet satisfactorily shows that symptoms of acute poisoning, gastro-enteritis and death, are sooner or later the results of the adoption of this dangerous practice in Styria. It would be difficult to persuade an English peasant, however ill-educated, that he could safely put into his daily food a substance which he used for destroying vermin,—or an English woman, that she could safely take, to improve her personal attractions, a mineral which pregnant women were in the habit of using to procure abortion (p. 7). It is a strange and inexplicable circumstance, if this practice exists, that the medico-legal writers of Germany have not dealt with the question by a proper investigation of the alleged facts. In the recently published elaborate work of Casper ('Practisches Handbuch der gerichtlichen Medicin,' 1857–8), although the subject of arsenical poisoning is very fully treated, there is no reference to the existence of a class of toxophagists in Styria. The recent works of Böcker, Bock, and Otto, as well as the German Quarterly Journals devoted to Legal Medicine, are equally silent on the alleged practice. (See a paper by M. Kopp, 'Moniteur Scientifique,' Mars 1861, liv. 101, p. 106.)

The alleged impunity of the Styrians, in the habitual use of arsenic, may be occasionally quoted to explain the detection of the poison in a dead body or a motive for its purchase; but no scientific witness who has seen anything of the operation of arsenic, can allow these statements to influence his opinion of its effects on human beings. Those who profess to believe in this practice, would be among the last to make a trial of it either on their own persons or among their friends.

The only form in which I have known the question of habit to be seriously raised in medical jurisprudence is this: whether, while the more prominent effects of a poison are thereby diminished, the insidious or latent effects on the constitution, are at the same time counteracted. The answer is of some importance in relation to the subject of life insurance:—for the concealment of the practice of opium-eating by a person whose life was insured, has already given rise to an action, in which medical evidence on this subject was rendered necessary. As a general principle, we must admit that habit cannot altogether counteract the insidious effects of poisons; and that the practice of taking them is liable to give rise to disease or to impair the constitution.

Influence of Idiosyncrasy.—Idiosyncrasy differs from habit:—it does not, like habit, diminish the effect of a poison: for it is not commonly found that any particular state of body is a safeguard against the effects of these powerful agents. Some constitutions are observed to be much more affected than others by certain poisons: thus opium, arsenic, mercury, lead, and antimony are substances of this description, and this difference in their effect is ascribed to idiosyncrasy. Dr. Christison mentions a remarkable instance, in which a gentleman unaccustomed to the use of opium, took nearly an ounce of laudanum without any effect. ('On Poisons,' 33.) This form of idiosyncrasy is very rare. Certain substances generally reputed harmless, and, indeed, used as articles of food, are observed to affect some persons like poisons. This is the case with pork, certain kinds of shell-fish, and mushrooms. There may be nothing poisonous in the food itself; but it acts as a poison in particular constitutions—whether from its being in these cases a poison *per se*, or rendered so by changes during the process of digestion, it is difficult to say. The subject of idiosyncrasy is of importance in a medico-legal view when symptoms resembling those of poisoning, follow a meal consisting of a particular kind of food. In such a case, without a knowledge of this peculiar condition, we might hastily attribute to poison, effects which were really due to another cause. It would appear that in some instances idiosyncrasy may be acquired—*i. e.* a person who, at one period of his life, had been in the habit of partaking of a particular kind of food without injury, may find at another period that it will disagree with him. When pork has been disused as an article of diet for many years it cannot always be resumed with impunity. In cases in which the powers of life have become enfeebled by age, the susceptibility of the system to poisons is increased; thus aged persons may be killed by comparatively small doses of arsenic and opium. Cases of acquired idiosyncrasy are very rare; it appears to be, if we may so apply the term, a congenital condition. There are, however, certain diseases which appear to confer a power of supporting large and even poisonous doses of some substances. Very large doses of opium have been taken without producing dangerous symptoms by persons labouring under tetanus and hydrophobia. This condition is called *tolerance.* It has been witnessed in diseases of the lungs in reference to the use of antimonial medicines.

CLASSIFICATION OF POISONS.—Poisons have been divided into three classes, according to their mode of action on the system; namely, IRRITANTS, NARCOTICS, and NARCOTICO-IRRITANTS. This classification is a modification of that originally proposed by Orfila. The Narcotics and Narcotico-irritants may, however, be regarded as constituting one large class, the NEUROTICS, as their special action is to affect directly one or more parts of the nervous system. The Neurotic poisons admit of a subdivision into Cerebral, Spinal, and Cerebro-spinal, according to whether the poisonous substance affects directly the brain, the spinal marrow, or both of these organs.

IRRITANTS.—The irritants are possessed of these common characters. When taken in ordinary doses, they occasion speedily violent vomiting and purging. The symptoms are either accompanied or followed by pain in the stomach and bowels. The peculiar effects of the poison are manifested chiefly on these organs, which, as their name implies, they irritate and inflame. Many substances belonging to this class of poisons possess corrosive properties; such as the strong mineral acids, caustic alkalies, bromine, corrosive sublimate, and others. These, in the act of swallowing, are commonly accompanied by an acrid or burning taste, extending from the mouth down the gullet to the stomach. Some irritants do not possess any corrosive action—of which we have examples in arsenic, the poisonous salts of baryta, carbonate of lead, and cantharides; these are often called pure irritants. They exert no destructive chemical action on the tissues with which they come in contact; they simply irritate and inflame them.

Difference between Corrosive and Irritant Poisons.—As a result of the action of *corrosive* poisons, symptoms are commonly manifested immediately, because mere contact produces the destruction of a part. In the action of the purely *irritant* poisons, the symptoms are generally more slowly manifested, rarely showing themselves until at least half an hour has elapsed from the time of swallowing the substance. Of course, there are exceptions to this remark; for sometimes irritants act speedily, though rarely with the rapidity of corrosive poisons. It is important in a practical view, to ascertain whether, in an unknown case, the poison which a person, requiring immediate treatment, may have swallowed, is irritant or corrosive. This may be commonly determined by a knowledge of the time at which the symptoms appeared after the suspected substance was taken. We may thus often easily distinguish between a case of poisoning from arsenic and one from corrosive sublimate. There is also another point which may be noticed. As the corrosive substance exerts a decidedly chemical action, an examination of the mouth and throat may enable us in some cases to solve the question.

It has already been stated that there are many irritant poisons which have no corrosive properties, but every corrosive may act as an irritant. Thus the action of corrosive sublimate is that of an irritant poison, as, while it destroys some parts of the coats of the stomach and intestines, it irritates and inflames others. So again most corrosive poisons may lose their corrosive properties by dilution with water, and then they act simply as irritants. This is the case with the mineral acids, and bromine. In some instances, it is not easy to say whether an irritant poison possesses corrosive properties or not. Thus oxalic acid acts immediately, and blanches and softens the mucous membrane of the mouth and throat, but I have not met with any decided marks of chemical corrosion produced by it in the stomach or viscera. Irritant poisons, for the most part, belong to the mineral kingdom; and they may be divided into the *Non-metallic* and *Metallic* irritants. There are a few derived from the animal and vegetable kingdom; but these, if we except cantharides, are not often employed criminally. Some of the gases likewise belong to the class of irritant poisons.

NEUROTICS.—Neurotic poisons act upon the nervous system, and their operation is confined chiefly to the brain and spinal marrow. Either immediately or some time after the poison has been swallowed, the patient suffers from head-ache, giddiness, numbness, paralysis, stupor, and in some instances convulsions. They have not an acrid burning taste like the corrosive irritants; and they rarely give rise to vomiting or purging. When these symptoms follow the ingestion of the poison into the stomach, the effect may be generally ascribed either to the form or quantity in which it has been taken, and the mechanical effect on the stomach thereby produced, or to the poison being combined with some irritating substance, such as alcohol. The pure *narcotics*, or *Cerebral poisons*, are not found to irritate or inflame the stomach and bowels.

Notwithstanding the well-defined boundary thus apparently existing between these two classes of poisons, it must not be supposed that the substances arranged in each class, always act in the manner indicated. Some irritants have been observed to affect the brain or the spinal marrow, and this may be either a primary or a secondary consequence of their action. Arsenic and oxalic acid, although classed as irritants, have in some instances given rise to symptoms closely resembling those of narcotic poisoning; namely, coma, paralysis, and tetanic convulsions. In a case of poisoning by arsenic, which ccurred to Dr. Morehead, of Bombay, the symptoms of narcotism were so trongly marked, that it was believed at first the man had taken a nar- otic. ('Med. Gaz.' vol. 43, p. 1055.) I have met with a case of poisoning y arsenic in which there was paralysis of the limbs, with an entire absence f purging, during the eight days that the deceased survived. On the other and, in a case of poisoning by a large dose of opium, there was an absence f the usual symptoms of cerebral disturbance, and the presence of others esembling those of irritant poisoning—namely, pain and vomiting. Thus, hen, we must not allow ourselves to be misled by the idea that the symptoms re always clearly indicative of the kind of poison taken. The narcotic or rebral poisons are few in number, and belong to the vegetable kingdom. ome of the poisonous gases possess a narcotic action.

Narcotico-Irritants. (*Spinal and Cerebro-spinal Poisons.*)—Poisons be- nging to this class have, as the name implies, a compound action. They e chiefly derived from the vegetable kingdom. At variable periods after ey have been swallowed, they give rise to vomiting and purging, like irri- nts; and sooner or later produce stupor, coma, paralysis and convulsions, ving to their effects on the brain and spinal marrow. In the state of getables, as leaves, seeds, or roots, they possess the property, like irritants, irritating and inflaming the stomach and bowels. As familiar examples e may point to nux vomica, monkshood, hemlock, and poisonous mushrooms. his class of poisons is very numerous, embracing a large variety of well- own vegetable substances; but they rarely form a subject of difficulty to a edical practitioner. The fact of the symptoms occurring after a meal at hich some suspicious vegetables may have been eaten, coupled with the ture of the symptoms themselves, will commonly indicate the class to which poison belongs. Some of these poisons have a hot acrid taste; others, e aconite or monkshood, produce a sense of numbness or tingling, while hers again have an intensely bitter taste, as nux vomica, strychnia, veratria, d picrotoxia. Strychnia may be regarded as a pure spinal poison.

CHAPTER 9.

EVIDENCE OF POISONING IN THE LIVING SUBJECT—ACTION OF POISONS INCREASED OR DIMINISHED BY DISEASE—SYMPTOMS CONNECTED WITH FOOD OR MEDICINE—SEVERAL PERSONS ATTACKED SIMULTANEOUSLY—EVIDENCE FROM THE DETECTION OF POISON IN THE FOOD.

We now proceed to consider the evidence of poisoning in the *living* subject. To the practitioner the diagnosis of a case of poisoning is of great importance, as by mistaking the symptoms produced by a poison for those arising from natural disease, he may omit to employ the remedial measures which have been found efficacious in counteracting its effects, and thus lead to the certain death of the patient. To a medical jurist a correct knowledge of the symptoms furnishes the chief evidence of poisoning, in those cases in which persons are charged with the malicious and unlawful administration of poison. The symptoms produced during life, constitute also an important part of the evidence in those instances in which a poison proves fatal. At present, however, we will suppose the case to be, that poison has been taken and the patient survives. Most toxicological writers have laid down certain characters whereby it is said symptoms of poisoning may be distinguished from those of disease.

1. *In poisoning, the symptoms appear suddenly, while the individual is in health.*—It is the common character of most poisons, when taken in the large doses in which they are usually administered with criminal intent, to produce serious symptoms, either immediately or within a very short period after they have been swallowed. Their operation, under such circumstances, cannot be suspended, and then manifest itself after an indefinite interval; although this was formerly a matter of universal belief, and gave rise to many absurd accounts of what was termed *slow* poisoning.

The symptoms of poisoning by nicotina, prussic acid, oxalic acid, or the salts of strychnia, appear immediately, or generally within a very few minutes after the poison has been swallowed. In an exceptional case, in which the dose of prussic acid was small, and insufficient to produce death, the poison was supposed by the patient not to have begun to act until after the lapse of fifteen minutes. ('Ed. Med. and Surg. Journ.' vol. 59, p. 72.) The symptoms caused by arsenic and other irritants, and, indeed, by all poisons generally, are commonly manifested in from half an hour to an hour. It is rare that the appearance of symptoms is protracted for two hours, except under certain peculiar states of the system. It is said that some neurotic poisons, such as the poisonous mushrooms, may remain in the stomach twelve or twenty-four hours without giving rise to symptoms; and this is also affirmed to be the case with some animal irritants, such as decayed meat; but with regard to the first point, it has been shown by Dr. Peddie that mushrooms have produced symptoms in half an hour; and a case has fallen under my own observation, in which the symptoms from noxious animal food came on within as short a time after the meal, as is commonly observed in irritant poisoning by mineral substances. In some cases of poisoning by phosphorus, no symptoms have occurred until after the lapse of some hours.

Influence of Disease.—A *diseased* state of the body may render a person comparatively unsusceptible of the action of certain poisons, while in other instances it may increase their action, and render them fatal in small doses. In dysentery and tetanus a person may take, without being materially affected, a quantity of opium sufficient to kill an adult in average health. In mania, cholera, hysteria, and delirium tremens, large doses of opium may be borne with comparative impunity (p. 135). In a case of hemiplegia, a woman æt. 29, took for six days, three grains of strychnia daily without injurious consequences —the dose having been gradually raised ('Gaz. Méd.' Mai 1845); while one grain of strychnia is commonly regarded as a fatal dose to a healthy adult. In a case of tetanus, Dupuytren gave as much as two ounces of opium at a dose (60 grammes), without serious consequences. (Flandin, 'Traité des Poisons,' vol. 1, p. 231.) It has also been remarked that persons affected with tetanus are not easily salivated by mercury. The morbid state appears to create the power of resisting the ordinary effects of poisons. ('Colles's Lectures,' vol. 1, p. 77.) The effect of certain diseases of the nervous system, as well as of habit, either in retarding the appearance of symptoms or in blunting the operation of a poison, it is not difficult to appreciate; they are cases which can present no practical difficulty to a medical jurist. On the other hand, in certain diseased states of the system, there may be an increased susceptibility of the action of poison. Thus, in those persons who have a disposition to apoplexy, a small dose of opium may act more quickly and prove fatal. In a person labouring under inflammation of the stomach or bowels, there would be an increased susceptibility to the action of arsenic, antimony, or other irritants. In debility from any cause these mineral substances would also act injuriously even in ordinary doses. Antimony is a most powerful depressant, and might, by its effect on the heart, cause death by syncope. The influence of disease in increasing the operation of poison, has been noticed in cases of diseased kidney (granular degeneration), in which small doses of mercury have produced severe salivation, leading to exhaustion and death. In diseases of the lungs affecting aged persons, opium in medicinal doses, has been observed to exert a poisonous action. The effect of the drug appears to be intensified by the disease. This observation applies equally to morphia. Chloroform vapour in ordinary quantity has been found to produce fatal effects, in cases in which there was latent disease of the heart or of the coronary arteries of this organ. A fatty condition of the muscular tissue leading to great feebleness of the heart's action, appears to be highly favourable to death by syncope, under the use of chloroform. A knowledge of these facts is of importance in reference to charges of malapraxis when death has arisen from ordinary or extraordinary doses of medicines, administered to persons labouring under disease. In such cases, another mode of treatment should be substituted, or a smaller dose than usual given, and its effects carefully watched. In some instances, however, full and large doses of powerful drugs have been recklessly given, and when a fatal result has followed, there has been a strong disposition to refer death to the supposed disease, of which, however, sometimes no trace could be found in the body. An experienced physician, well acquainted with pathological anatomy, informs me that since the use of chloroform has become general, and deaths under its use are not unfrequent, a fattiness and flabbiness of the muscular structure of the heart has been sought for and almost universally found! The fatal result has not been attributed to its real cause, the imprudent or careless administration of chloroform, but to some minute structural changes revealed by the microscope in the substance of the organ.

Symptoms appear during a state of health.—Symptoms of poisoning may manifest themselves in a person while in a state of *perfect health*, without any apparent cause. This rule is of course open to numerous exceptions, because the person on whose life an attempt has been made, may be actually labouring under disease; and under these circumstances, the symptoms may be so obscure as often to disarm all suspicion. When poison is exhibited in medicine, a practitioner is very liable to be deceived, especially if the disease under which the person is labouring is of an acute nature, and is attended by symptoms of disorder in the alimentary canal. Several cases of poisoning have occurred in which arsenic was criminally substituted for medicine, and given to the parties while labouring under a disorder of the bowels. We are, however, justified in saying, with respect to this character of poisoning, that when in a previously healthy person, violent vomiting and purging occur suddenly and without any assignable cause, such as pregnancy, disease, or indiscretion in diet, to account for them, there is strong reason to suspect that irritant poison has been taken. When the person is already labouring under disease, we must be especially watchful on the occurrence of any sudden change in the character or violence of the symptoms, unless such change can be easily accounted for on common or well-known medical principles. In most cases of criminal poisoning we meet with alarming symptoms without any obvious or sufficient natural causes to explain them. The practitioner will of course be aware that there are certain diseases which are liable to occur suddenly in healthy people, the exact cause of which may not at first sight be apparent; therefore this criterion is only one out of many on which a medical opinion should be founded.

2. *In poisoning the symptoms appear soon after a meal, or soon after some kind of food or medicine has been taken.*—This is by far the most important character of poisoning in the living body. It has been already stated that most poisons begin to operate within about an hour after they have been swallowed; and although there are a few exceptions to this remark, yet they occur under circumstances easily to be appreciated by a practitioner. Thus, then, it follows that, supposing the symptoms under which a person is labouring, to depend on poison, the substance has most probably been swallowed, either in food or medicine, from half an hour to an hour previously. It must be observed, however, that cases may occur in which the poison has not been introduced by the mouth. Oil of vitriol and other corrosive liquids have been thrown up the rectum in injections, and have thus caused death; the external application of arsenic, corrosive sublimate, and cantharides to ulcerated surfaces has destroyed life. In one case, arsenic was introduced into the vagina of a female, and she died in five days under all the symptoms of arsenical poisoning. (Schneider, 'Ann. der ges. Staatsarzneikunde,' i. 229.) Such cases are rare, but, nevertheless, the certainty that they have occurred, where their occurrence could hardly have been anticipated, shows that in a suspicious case a practitioner should not deny the fact of poisoning, merely because it may be proved that the person could not have taken the poison in the usual way, by the mouth. Again, persons may be destroyed by the vapours of ether, chloroform, prussic acid, or other powerful volatile poisons, introduced into the body through the lungs. Such a mode of suicide, or murder, might disarm suspicion, from the fact of no noxious material being found in the stomach.

Let us suppose, however, the circumstances to have been such that these secret means of destruction could not have been resorted to, and that the poison is one of those most commonly selected by a murderer, such as arsenic, tartar emetic, oxalic acid, or corrosive sublimate, then we may expect that this character of poisoning will be made evident to us, and that something must have been *swallowed* by the patient shortly before the alarming symptoms appeared. By observations attentively made, it may be in our power to connect the appearance of the symptoms with the use of a particular article of food, and thus indirectly lead to the detection of a criminal. Supposing that many hours have passed since food or medicine was taken by the patient, without any effect ensuing—it is probable that the symptoms are due to natural causes and not to poison. When symptoms resembling those of poisoning speedily follow the ingestion of food or medicine, there is, however, reasonable ground for suspicion; but caution should be observed in drawing inferences, since the most extraordinary coincidences sometimes present themselves. In the case of *Sir Theodosius Boughton*, who was poisoned by his brother-in-law, Donellan, in 1781, the fact of alarming symptoms coming on in *two minutes* after the deceased had swallowed what was supposed to be a simple medicinal draught, was a most important fact in the evidence against the prisoner. There is no doubt that laurel-water had been substituted for the medicine by the prisoner, and that this had caused the symptoms which preceded death. The practice of substituting poisonous mixtures for medicinal draughts or powders is by no means unusual, although it might be supposed to indicate a degree of refinement and knowledge not commonly to be found among criminals. Medical practitioners are thus apt to be imposed upon, and the following case, related by a deceased judge, will serve as a caution :—An apothecary prepared a draught, into which another person put poison, intending thereby to destroy the life of the patient for whom the medicine was prescribed. The patient, not liking the taste of the draught, and thinking there was something suspicious about it, sent it back to the apothecary, who, knowing the ingredients of which he had composed it, and wishing to prove to his patient that he had done nothing wrong, drank it himself, and died from the effects. He was thus the unconscious agent of his own death; and although the draught was intended for another, the party who poisoned it, was held guilty of murder. This case contains a warning to medical witnesses. It is not unusual, on trials for poisoning, when the poison is conveyed through medicine, to find a medical witness offering to swallow his own draught in a Court of Law, in order to furnish a convincing practical illustration of the innocence of the medicine! It need hardly be observed that an exhibition of this kind is never required of a medical witness. If any doubt be raised of the innocent properties of a draught or powder, a hemical analysis of its contents will be far more satisfactory, and attended with no kind of risk to the practitioner.

On the other hand, the occurrence of symptoms resembling those produced y poisoning, soon after food or medicine has been taken, may be a pure oincidence. In such a case, poison is always suspected by the vulgar; and will be the duty of a medical jurist to guard against the encouragement of uch a suspicion, until he has strong grounds to believe it to be well founded. To public retractation or apology can ever make amends for the injury which ay in this way be inflicted on the reputation of another; for those who hear e accusation may never hear the defence. In all such cases, a practitioner ay entertain a suspicion, but, until confirmed by facts, he should avoid *xpressing* it, or giving it publicity. When death is not a consequence, it is ifficult to clear up such cases, except by the aid of a chemical analysis; but is, as we know, is not always applicable. If death ensue, the real cause is sually apparent, and a suspicion of poisoning is thus often removed by an xamination of the body.

3. *In poisoning, when several partake at the same time of the same food or edicine (mixed with poison) all suffer from similar symptoms.*—This character poisoning cannot always be procured; but it furnishes good evidence of e fact when it exists. Thus, supposing that after a meal made by several rsons from the same dish, only one suffers, the suspicion of poisoning is nsiderably weakened. The poisoned article of food may be detected by serving whether they who suffer under any symptoms of poisoning, have rtaken of one particular solid or liquid in common. In a case of accidental isoning at a dinner-party, a medical man who was present observed that ose who suffered had taken port-wine only: the contents of the bottle were amined, and found to be a saturated solution of arsenic in wine. In general, nsiderable reliance may be placed upon this character, because it is

improbable that any common cause of disease should suddenly attack with violent symptoms of a similar character, many healthy persons at the same time, and within a short period after having partaken of food together. We must beware of supposing that, when poison is really present, all will be attacked with precisely similar symptoms; because there are many circumstances which may modify their nature and progress. In general that person who has partaken most freely of the poisoned dish will suffer most severely; but even this does not always follow. There is a well-known case, recorded by Bonnet, where, among several persons who partook of a dish poisoned with arsenic, they who had eaten little and *did not vomit*, speedily died; while others who had partaken largely of the dish, and had in consequence vomited freely, recovered.

It was just now remarked, that there is no disease resembling poisoning which is likely to attack several healthy persons at the same time, and in the same manner. This is undoubtedly true as a general principle, but the following case will show that mistakes may occasionally arise even under these circumstances. It occurred in London, during the prevalence of the malignant cholera in the year 1832. Four of the members of a family, living in a state of great domestic unhappiness, sat down to dinner in apparently good health: some time after the meal, the father, mother, and daughter, were suddenly seized with violent vomiting and purging. The evacuations were tinged with blood, while the blueness of the skin, observed in cases of malignant cholera, was absent. Two of these persons died. The son, who was known to have borne ill-will against his father and mother, and who suffered no symptoms on this occasion, was accused of having poisoned them. At the inquest, however, it was clearly shown by the medical attendant, that the deceased persons had really died of malignant cholera, and there was no reason to suspect that any poison had been administered to them. In this instance it will be perceived that symptoms resembling those of irritant poison, appeared suddenly in several individuals in perfect health, and shortly after a meal. We hereby learn that the utility of any rules for investigating cases of poisoning, depends entirely on the judgment and discretion with which they are applied to particular cases.

It is well to bear in mind, in conducting these enquiries, that symptoms resembling those produced by irritant poison, may be sometimes traced to *food*. Meat, rendered unwholesome by disease or decay, pork, bacon, sausages, cheese and bread, as well as certain kinds of shell-fish, may give rise to symptoms of poisoning, and even cause death. Such cases may be regarded as poisoning by animal or vegetable irritants. All the characters above described, as indicative of poisoning, may be observed, and the difficulty of forming an opinion is often increased by the fact that some of the persons attacked, may have previously partaken of the same kind of food without inconvenience.

4. *The discovery of poison in the food taken, or in the matters vomited.*—One of the strongest proofs of poisoning in the living subject, is the detection of poison by chemical analysis, or, if of a vegetable nature, by a microscopical examination, either in the food taken by the person labouring under its effects, or in the matters vomited, or, after the lapse of a few hours, in the urine. The evidence is of course more satisfactory when the poison is detected in the matters vomited or in the urine, than in the food; because this will show that it has really been taken, and it will readily account for the symptoms. If the vomited matters have been thrown away, we must examine the food of which the patient may have partaken. Should the results in both cases be negative, and no trace of poison be found in the urine, it is probable that the symptoms were due to disease.

In investigating a case of poisoning in a living subject, a medical jurist nust remember, that poisoning is sometimes *feigned*, and at others *imputed*. t is easy for an artful person to put poison into food, as well as to introduce t into the matters vomited or discharged from the bowels, and to accuse nother of having administered it. There are few of these accusers who go o far as to swallow poison under such circumstances, as there is a great lread of poisonous substances among this class of criminals; and it will be t once apparent, that it would require a person well versed in toxicology, to eign a series of symptoms which would impose upon a practitioner at all cquainted with the subject. In short, the difficulty reduces itself to this:—Vhat inference can be drawn from a chemical detection of poison in food? ll that a medical man can say is, whether poison is or is not present in a articular article of food: he must leave it to the authorities of the law to evelope the alleged attempt at administration. If the poison has been ctually administered or taken, then we should expect to find that the person ad suffered from the usual symptoms. The absence of these symptoms ould be a strong fact against the alleged administration. The detection of oison in the matters vomited, affords no decisive proof that it has been wallowed, except under two circumstances:—1. When the accuser has reviously laboured under the usual symptoms of poisoning, in which case here can be no feigning, and the question of imputation is a matter to be stablished by general evidence. 2. When the matters are actually vomited nto a *clean vessel* in the presence of the medical attendant himself, or of ome person on whose testimony perfect reliance can be placed. The detec-ion of absorbed poison in the *urine*, furnishes a clear proof that poison has een taken, that it has passed into the blood, and has been subsequently iminated.

CHAPTER 10.

THE EVIDENCE OF POISONING IN THE DEAD BODY — PERIOD AT WHICH POISONS PROVE FATAL — CHRONIC POISONING — APPEARANCES PRODUCED BY THE DIFFERENT CLASSES OF POISONS — REDNESS OF THE MUCOUS MEMBRANE MISTAKEN FOR INFLAMMATION — ULCERATION AND CORROSION — SOFTENING — PERFORATION OF THE STOMACH FROM POISON AND DISEASE.

JPPOSING that the person is dead, and we are required to determine whether e case is one of poisoning or not, we must, in the first instance, endeavour ascertain all the particulars which have been considered in the last chapter, indicative of poisoning in the living subject. Should the deceased have ed from poison, the circumstances of the attack, and the symptoms pre-ding death, ought to correspond with the characters already described; and these investigations, it is well to bear in mind the following rule:—There no one symptom or pathological condition which is peculiar to poisoning; it at the same time there is probably no disease which presents *all* those aracters which are met with in a special case of poisoning. The additional idence to be derived from the *death* of a person, may be considered under e following heads:—

1. *The time at which death takes place after the first occurrence of nptoms.*—This question requires examination, because the more common isons, when taken in fatal doses, generally cause death within definite riods of time. By an attention to this point, we may, in some instances, enabled to negative a charge of poisoning, and in others to form an opinion the kind of poison which has been taken. In a Court of Law a medical actitioner is often required to state the usual *period of time* within which

poisons prove fatal. It is to be observed that, not only do poisons differ from each other in this respect, but the same substance, according to the form or quantity in which it has been taken, may differ in the rapidity of its action. A large dose of prussic acid, *i. e.* from half an ounce to an ounce, may destroy life in less than two minutes. In ordinary cases of poisoning by this substance a person dies, *i. e.* all signs of life have commonly ceased, in from ten to twenty minutes: if he survives half an hour, there is some hope of recovery. In the cases of seven epileptics, accidentally poisoned by a similar dose of this acid in one of the Parisian hospitals, the first died in about twenty minutes, the seventh survived three-quarters of an hour. Oxalic acid, one of the most energetic of the common poisons, when taken in a dose of from half an ounce to an ounce, may destroy life in from ten minutes to an hour: if the poison is not perfectly dissolved when swallowed, it is a longer time in proving fatal. The strong mineral acids, in poisonous doses, destroy life in about eighteen or twenty-four hours. Arsenic, under the form of arsenious acid (white arsenic), operates fatally in from eighteen hours to three or four days. It has, however, in more than one instance, killed a person in two hours. Opium, either as a solid or under the form of laudanum, commonly proves fatal in from six to twelve hours; but it has been known, in several instances, to destroy life in less than three hours: they who survive the effects of this poison for twelve hours, are considered to have a fair chance of recovery. This must be understood to be merely a statement of the average results, as nearly as we are warranted in giving an opinion; but the medical jurist will of course be aware that the fatal period may be protracted or shortened, according to all those circumstances which have been elsewhere stated to affect the action of poisons.

There are various forms which this question may assume. It may be said that the death of a person, alleged to have taken poison, has occurred too rapidly or too slowly to justify a suspicion of poisoning. The following case will serve as an illustration: A woman of the name of *Russell* was tried and convicted at the Lewes Summer Assizes, in 1826, for the murder of her husband, by poisoning him with arsenic. The poison was detected in the stomach; but the fact of poisoning was disputed by some medical witnesses, for this among other reasons, that the deceased had died *three* hours after the only meal at which the poison could have been administered to him. The authority of Sir A. Cooper and others was cited to show that, according to their experience, they had never known a case of poisoning by arsenic to have proved fatal in less than seven hours. This may be admitted, but, at the same time, there was sufficient authority on the other side to establish that some cases had actually proved fatal in three or four hours. So far as this objection was concerned, the prisoner was properly convicted. In reference to the medical question raised at this trial, I may observe that two distinct cases have occurred in which the individuals died certainly within *two hours* after taking arsenic; and several instances have been reported, in which death has taken place in from three to four hours after the administration of this poison. It seems extraordinary in the present day, that any attempt should have been made by a professional man to negative a charge of criminal poisoning upon so weak a ground as this; but this opinion was expressed many years ago, when the facts connected with poisoning were but little known. It is quite obvious that there is nothing, so far as we know, to prevent arsenic from destroying life in an hour, or even within a shorter period. A case will be hereafter related, in which death took place from arsenic probably within twenty minutes. These matters can be settled only by a careful observation of numerous cases, and not by any *à priori* reasoning, or by a limited individual experience.

In all instances of sudden death there is generally a strong tendency on the part of the public to suspect poisoning. They never can be brought to consider that persons may die a natural death *suddenly*, as well as slowly; or, as we shall presently see, that death may really take place slowly, and yet be due to poison. This prejudice continually gives rise to the most unfounded suspicions of poisoning, and, at the same time, leads to cases of chronic or slow poisoning being frequently mistaken for natural disease. One of the means recommended for distinguishing narcotic poisoning from apoplexy or disease of the heart, is the difference in the rapidity with which death takes place. Thus, apoplexy or disease of the heart may prove fatal either instantly or within an hour. The only poisons likely to operate with such fatal rapidity, are prussic acid or nicotina. Poisoning by opium is commonly protracted for five or six hours. This poison has never been known to destroy life instantaneously, or within a few minutes. Thus, then, it may happen that death will occur with such rapidity as to render it impossible, under the circumstances, to attribute it to narcotic poison.

Chronic poisoning.—When a poison destroys life rapidly, it is called a case of *acute* poisoning, to distinguish it from the *chronic* form, i. e. in which death takes place slowly. Chronic poisoning is a subject which has of late frequently required medico-legal investigation. Most poisons, when their effects are not rapidly manifested, owing either to the smallness of the dose or to timely treatment, are capable of slowly undermining the powers of life, and killing the patient by producing emaciation and exhaustion. This is sometimes observed in the action of arsenic, corrosive sublimate, and tartarized antimony, but it has been remarked also in cases of poisoning by the mineral acids and caustic alkalies. Death is here an indirect consequence; —in poisoning by the acids or alkalies, either stricture of the gullet is induced, or the lining membrane of the stomach is destroyed, and the process of digestion impaired, a condition which leads to exhaustion and death. The time at which these indirect effects may prove fatal, is of course liable to vary. A person has been known to die from a stricture of the gullet, brought on by sulphuric acid, *eleven months* after the poison was swallowed; nd there is no reason to doubt that instances may occur of a still more rotracted nature. In cases of *chronic poisoning* there is sometimes great ifficulty in assigning death exclusively to the original action of the poison, nce the habits of life of the person, a tendency to disease, and other ircumstances, may have concurred either to accelerate or produce a fatal esult. To connect a stricture of the gullet proving fatal, with the effects of oisoning by a mineral acid, it would be necessary to show that there was o tendency to this disease before the acid was administered: that the ymptoms appeared soon after the first effects of the poison went off: hat these symptoms continued to become aggravated until the time of eath, and lastly that there was no other cause to which death could with any robability be referred. These remarks apply equally to the secondary tal effects of any poison, such, for instance, as the salivation occasionally duced by corrosive sublimate, and the exhaustion and depression which are used by tartarized antimony, when the acute symptoms of poisoning by ese substances have passed away.

Several cases have come before our tribunals, in which the facts connected th this form of poisoning were of some importance. I allude to those of ss *Blandy*, tried at Oxford, in 1752, for the murder of her father by enic; and of a woman named *Butterfield*, tried at Croydon, in 1775, for e murder of a Mr. Scawen, by administering corrosive sublimate. Among ses of recent occurrence, may be mentioned that of Mrs. Wooler (*Reg.* v. *ooler*, Durham Winter Assizes, 1855), in which it was clearly proved that the deceased had been under the influence of arsenic, administered at intervals in repeated doses, for a period of about seven weeks before her death. She died from exhaustion and the secondary effects of the poison. In three other cases tartarized antimony was the poison selected. It was given in repeated doses, over different periods, and caused death, by the specific effects of poisoning in a chronic form. 1. The case of *Ann Palmer.* (‘Guy's Hospital Reports,’ October 1857.) 2. The case of *M‘Mullen* (Liverpool Summer Assizes, 1856), in which a woman was tried and convicted for causing the death of her husband; and 3rd, the case of *Reg.* v. *Hardman* (Lancaster Summer Assizes, 1857), in which a man was convicted of the murder of his wife. In most cases, murderers destroy life by administering poison in large doses; but in the instances referred to, small doses were given at intervals, a fact which, in some of them, led to a medical doubt of the real cause of the symptoms. The case of *Isabella Banks* (*Reg.* v. *Smethurst*, Central Criminal Court, August, 1859) gave rise to a conflict of medical opinion respecting the cause of death. Drs. Julius and Bird, who attended the deceased throughout her illness of about a month's duration, the late Dr. Todd, and myself, referred the symptoms and cause of death to chronic poisoning by antimony and arsenic, and in confirmation of this opinion, antimony was distinctly found by Dr. Odling and myself in the intestines after death. Arsenic was also found in an evacuation passed by the deceased three days before her death. Dr. Tyler Smith, Dr. Richardson, and others, who did not see the deceased, ignoring the existence of antimony in the body, referred the symptoms and appearances partly to pregnancy, and partly to a sudden attack of severe dysentery. The jury found the accused guilty, but upon the medical doubt thus raised in the public mind respecting the cause of death, the accused was subsequently discharged. A similar question arose in *Reg.* v. *Winslow.* (Liverpool Autumn Assizes, 1860.) The prisoner was charged with the murder of a Mrs. James by administering to her small doses of antimony. The suspicions of Dr. Cameron, who attended deceased, were excited by the intermittent and violent nature of the vomiting, as well as by the extreme depression. Antimony was found in the urine and fæces by Dr. Edwards; and, after death, this substance was discovered, in small quantity, in the viscera, by Dr. Edwards, Dr. Miller, and myself. The deceased was at the time labouring under malignant disease of the cæcum, but it was alleged that the antimony had accelerated her death. The jury acquitted the accused. The examination of the bodies of the sister of deceased, as well as of two other members of the family, led to the discovery of antimony also in small quantity, in the viscera of each; and from the nature of the symptoms preceding death, as well as the general healthiness of the organs, no doubt was entertained by the medical witnesses that all these persons, members of the same household, had died from the effects of antimony administered at intervals in small doses. The law could not fix the perpetration of these four murders upon any person, and three would have wholly escaped public notice, but for the death of Mrs. James some months after the bodies of the others had been buried under medical certificates setting forth natural causes of death! The occurrence of such cases as these, of which no fewer than sixteen have been referred to me for examination since 1847, suggests grave reflections on the insecurity of life, when poison is used with skill and cunning, and demonstrates the inefficiency of the present system of registering causes of death. The editor of the Law Magazine has said, in commenting upon the *Smethurst* case, ‘All that is requisite for future murderers by poison to do, is to use small doses, combine the use of various destructive drugs, and subpœna the proper medical witnesses for the defence.’ (‘Law Magazine, Nov. 1859, p. 115.)

These cases show that medical men, in signing certificates, do not sufficiently inquire into the nature of the fatal illness, or the cause of death: but this is an evil which admits of an easy remedy. The public have much more to dread in the fact that, even in plain cases of poisoning, some physicians of experience and repute have been unable to discriminate the symptoms from those of natural disease. Thus, in the notorious case of *William Palmer*, one physician who appeared for the defence, affirmed that the symptoms under which Cook died were those of angina pectoris; while another physician, also employed for the defence, assigned death to epilepsy with tetanic complications! The witnesses came forward as experts to maintain these views, and to induce the Court and jury, as well as the public, to adopt one or the other. In reference to the death of *Ann Palmer*, which was caused by doses of antimony, the solid sulphide of this metal was found in the stomach after death, while the metal itself pervaded the whole of the tissues, a respectable physician, with only a superficial knowledge of the real facts of the case, wrote a pamphlet to prove that she had died from an attack of common cholera! If these gentlemen had been called in to attend these two victims of secret poisoning while living, it is quite obvious that they would have had no suspicion of poisoning, and that they would have respectively certified that death was caused in the one case by angina pectoris or epilepsy, nd in the other by cholera. They would thus have effectually screened, under erroneous medical certificates, the acts of a man who is now universally admitted to have been the greatest criminal of the age. If physicians of ome standing and professed experts, can thus overlook ordinary cases of oisoning, it is not surprising that general medical practitioners, who have ot given special attention to the subject of toxicology, should fall into the rror of granting erroneous medical certificates, and of certifying that death om arsenic or opium was due to cholera, convulsions, or apoplexy!

The characters of chronic poisoning have of late years acquired a special nterest for the medical jurist. There is a difficulty about them which no ccuracy of observation or judgment can surmount. The poison or poisons, found in the dead body at all, must necessarily exist in fractional parts of grain. This alone will be sufficient to create a doubt whether death has een caused by the poison, although it is quite consistent with medical experience that a person may die from chronic poisoning, and little or none of e poison be found in the body after death. In the case of Mrs. James (*Reg.* *Winslow*), not more than the tenth part of a grain was found in the whole the tissues of the body: in the case of Isabella Banks (*Reg.* v. *Smethurst*), e quantity was greater than this, but less than a grain altogether; while in e case of Mrs. *Peters*, of Yeovil, examined by Mr. Herapath, *none* was und in the body, although this chemist had extracted a quantity of antimony sulphide from the urine of deceased, in less than nine days before death! this case Dr. Garland had also found antimony in the evacuations during , and had referred the intermittent irritation of the stomach and bowels, m which deceased had suffered, to the secret use of this mineral. The jury urned a verdict that deceased had died from disease, and that death was celerated by some irritant. ('Lancet,' August 4th, 1860, p. 119.) On me recent trials for poisoning (*Reg.* v. *William Palmer*, C. C. C. 1856), it s been a contested scientific question, whether a person can die from poison d no trace of the poison remain in the body. Mr. Herapath's evidence in Mrs. ters' case not only now proves the affirmative, but goes to show that antimony y act fatally and be entirely eliminated from the system in about a week. Med. Times and Gaz.' Aug. 25, Sept. 15, and 29, 1860, pp. 190, 271, 317.)

2. *Evidence from Appearances in the Body.*—One of the chief means of termining whether a person has died from poison, is an examination of the

body after death. In relation to *external* appearances, there are none indicative of poisoning upon which we can safely rely. It was formerly supposed that the bodies of persons who were poisoned, putrefied more rapidly than those of others who had died from natural disease; and evidence for or against poisoning was at one time derived from the external appearance of the body. This is now known to be an error: the bodies of persons poisoned are not more rapidly decomposed, *cæteris paribus*, than those of others who have died a sudden and violent death from any cause whatever. (See p. 57.)

Irritant poisons act chiefly upon the stomach and intestines, which they irritate, inflame, and corrode. We may likewise meet with all the consequences of inflammation, such as softening, thickening, ulceration, perforation, or gangrene. Sometimes the coats of the viscera are thickened, at other times thinned and softened, by the action of an irritant.

Neurotic (*Cerebral and Spinal*) poisons do not commonly leave any well-marked appearances in the body. The stomach and intestines present no unnatural changes. There may be greater or less fulness of the vessels of the brain and spinal marrow, as well as of their membranes; but even this is often so slight as to escape notice, unless attention be particularly directed to these organs. Effusion of blood is rarely found.

The *Narcotico-irritant* or *Cerebro-spinal* poisons may affect either the brain or the stomach and bowels, and commonly all these parts according to their peculiar mode of action.

It is important to bear in mind, that both Irritants and Neurotics may destroy life without leaving any appreciable changes in the body. To such cases as these, the remarks about to be made do not apply. The proofs of poisoning must, in such exceptional cases, be procured entirely from other sources. Any evidence derivable from the appearances in the body of a person poisoned, will be imperfect unless we are able to distinguish them from those analogous changes often met with as the results of ordinary disease. These are confined to the mucous membrane of the stomach and bowels. They are redness, ulceration, softening, and perforation. Each of these conditions may depend upon disease, as well as upon the action of irritant poisons.

Redness.—It is a main character of the irritants to produce, as a result of inflammation, redness of the mucous or lining membrane of the stomach and small intestines. This redness, when first seen, is usually of a deep crimson colour, becoming brighter by exposure to air. It may be diffused over the whole mucous membrane: at other times it is seen in patches, dots, or lines (striæ), spread irregularly over the surface of the stomach. It is sometimes met with at the smaller, but more commonly at the larger end of this organ, and again we occasionally find the folds or prominences only of the mucous membrane presenting this red or inflamed appearance. Redness of the mucous membrane may, however, be due to gastritis or gastro-enteritis as a result of disease; and in order to assign the true cause of the inflammation, it will be necessary to have an account of the symptoms preceding death, or some chemical proof of the existence of irritant poison in the contents of the stomach or in the tissues of the body.

In the healthy state, the mucous membrane of the stomach is pale and white, or nearly so, except during digestion, when it is slightly reddened; and some observers have remarked that a slight redness has often remained in the stomachs of those who have died during the performance of the digestive process. When in contact with the spleen or liver, after death, the stomach is apt to acquire a deep livid colour from the transudation of blood; and it is well known that the bowels acquire a somewhat similar colour from the gravitation of blood which always takes place after death. None of these appearances are likely to be mistaken for the action of an irritant poison.

There is an important class of cases in which redness of the mucous membrane of the stomach is found after death, not dependent on the action f poison or on any easily assignable cause. These cases, owing to their being so little known, and involved in much obscurity, deserve the attention f a medical jurist, since the appearances closely resemble those produced by rritant poison. A person may die without suffering from any symptoms of disordered stomach; but on an inspection of the body, a general redness of he mucous membrane of this organ will be found, not distinguishable from he redness which is so commonly seen in arsenical poisoning. Several cases f this kind have occurred at Guy's Hospital: and drawings which have been made of the appearance presented by the stomach, are preserved in the Museum collection.

The redness of the lining membrane of the stomach, in cases of poisoning, s so speedily altered by putrefaction, when circumstances are favourable to his process, as frequently to render it impossible for a witness to speak with ny certainty upon its cause. Putrefactive infiltration from the blood contained in the adjacent viscera and muscles, will give a reddish-coloured ppearance to a stomach otherwise in a healthy condition (p. 52). Great ispute has arisen respecting the length of time during which redness of the stomach produced by an irritant will be recognizable and easily distinguishable rom putrefactive changes. It is sufficient to say, that no certain rule can be aid down on the subject: it must be left to the knowledge and discretion of he witness. I have distinctly seen the well-marked appearances of inflammation produced by arsenic in the stomach and duodenum in an exhumed body twenty-eight days after interment (*Reg.* v. *Jennings*, Berks Lent Ass. 1845); and in another instance, referred to me by Mr. Lewis, the coroner for Essex, in August 1846, the reddened state of the mucous membrane, in case of arsenical poisoning, was plainly perceptible on removing a layer of rsenic, *nineteen months* after interment. (See, on this question, a case of suspected poisoning by Orfila, 'Annales d'Hyg.' 1839, vol. 1, p. 127.) If, however, there should be a reasonable doubt respecting the cause of redness, and no poison is detected, it would be unsafe to rely upon this appearance as evidence of poisoning.

Ulceration.—In irritant poisoning, the stomach is occasionally found ulcerated: but this is, comparatively speaking, a rare occurrence. In such cases he mucous membrane is removed in small distinct circular patches, under the dges of which the poison (arsenic) may be found. Ulceration of the stomach a more common result of disease, than of the action of poison. As a consequence of disease, it is very insidious, going on often for weeks together, without giving any indications of its existence, except perhaps slight gastric sturbance with occasional nausea, vomiting, and loss of appetite. In this se, the ulceration is commonly seen in small circumscribed patches. It is orthy of remark, as a means of distinction, that ulceration has never been nown to take place from arsenic or any irritant poison, until symptoms dicative of irritant poisoning have occurred. In ulceration from disease, the ucous membrane is commonly only reddened in the neighbourhood of the cer. In ulceration from poison, the redness is generally diffused over other rts of the stomach, as well as over the duodenum and small intestines. A se, however, occurred in Guy's Hospital, some years ago, in which, with a mall circular patch of ulceration near the cardiac opening, the whole mucous embrane was red and injected; but this singular condition of the stomach, closely resembling the effects of an irritant poison, was unaccompanied any marked symptoms of irritation during life. The history of a case previous to death will thus commonly enable us to determine to what cause the ceration found, may be due. Care must be taken to distinguish ulceration from *corrosion.* Ulceration is a vital process: the substance of a part is removed by the absorbents as a simple result of inflammation. Corrosion, on the other hand, is a chemical action;—the parts are removed by the immediate contact of the poison: they are decomposed: their vitality is destroyed, and they combine with the corrosive matter itself. Ulceration requires time for its establishment, while corrosion is either an instantaneous or a very rapid effect.

Softening —The coats of the stomach are not unfrequently found so soft as to yield and break down under very slight pressure; and this may be the result either of poisoning, of some spontaneous morbid change in its structure during life, or of the solvent action of the gastric juice after death. As this condition of the stomach, when caused by poison, is produced by those substances only which possess corrosive properties, it follows that in such cases, traces of their action will be perceived in the mouth, throat, and gullet. In softening from disease, the change will be confined to the stomach alone, and it is commonly found only at the cardiac or greater end of the organ. When softening is really caused by an irritant poison, it is generally attended by other striking and unambiguous marks of its operation. Softening is not to be regarded as a common character of poisoning: it is only an occasional appearance. I have met with an instance in which the coats of the stomach were considerably hardened by sulphuric acid. Softening can never be inferred to have proceeded from poison, unless other well-marked changes are present, or unless the poison is discovered in the softened parts. The stomachs of infants have been frequently found softened from natural causes: such cases could not be mistaken for poisoning, since the history of them during life, the want of other appearances indicative of poisoning, and the total absence of poison from the viscera, would prevent such a suspicion from being entertained.

Perforation.—The stomach may become perforated, either as a result of poisoning or disease.

Perforation from Poisoning.—This may arise:—1, from corrosion; 2, from ulceration. The perforation by *corrosion* is by far the most common variety of perforation from poisoning. It is occasionally witnessed when the strong mineral acids have been taken, especially sulphuric acid:—the stomach, in such cases, is blackened and extensively destroyed, the aperture is large, the edges are rough and irregular, and the coats are easily lacerated. The acid escapes into the abdomen, and may be readily detected there by chemical analysis. The perforation from *ulceration*, caused by irritant poison (arsenic), is but little known. There are but few instances on record. In a great number of poisoned subjects examined during many years past at Guy's Hospital, not a single case has occurred. It must, then, be looked upon as a rare appearance in cases of irritant poisoning.

Perforation from Disease.—This is by no means an unusual condition. Many cases of this disease will be found reported elsewhere. ('Guy's Hosp. Rep.' No. 8.) It is invariably fatal when it proceeds so far that the contents of the stomach escape into the abdomen; but sometimes the stomach becomes glued to the pancreas or other organs during the ulcerative process, and then the person may recover. Several instances of this kind of adhesion have been met with in inspections. The symptoms from perforation commonly attack a person suddenly, while apparently enjoying perfect health. Hence these cases may be easily mistaken for those of irritant poisoning. The principal facts observed with regard to this formidable disease are the following: 1. It often attacks young females from eighteen to twenty-three years of age. 2. The preceding illness is extremely slight; sometimes there is merely loss of appetite, or a capricious appetite with uneasiness after eating. 3. The attack commences with a sudden and most severe pain in the abdomen, generally on after a meal. In irritant poisoning the pain usually comes on gradually, nd slowly increases in severity. 4. Vomiting, if it exist at all, is commonly ight, and is chiefly confined to what is swallowed. There is no purging: e bowels are generally constipated. In irritant poisoning the vomiting is sually severe, and purging seldom absent. 5. The person dies commonly in om eighteen to thirty-six hours: that is also the average period of death the most common form of irritant poisoning, i.e. by arsenic; but in no case et recorded has arsenic caused perforation of the stomach within twenty-four ours; and it appears probable that a considerable time must elapse before ch an effect could be produced by this or any irritant. 6. In perforation om disease, the symptoms and death are clearly referable to peritonitis. 7. the perforation from disease, the aperture is commonly of an oval or unded form, about half an inch in diameter, situated in or near the lesser urvature of the stomach, and the edges are smooth. The outer margin of e aperture is often blackened, and the aperture itself is funnel-shaped from ithin outwards, i.e. the mucous coat is the most removed, and the outer or eritoneal coat, the least. The coats of the stomach, round the edge of the erture, are usually thickened for some distance; and when cut they have most a cartilaginous hardness. These characters of the aperture will not one indicate whether it is the result of poisoning or disease; but the absence poison from the stomach, with the want of other characteristic marks of ritant poisoning, would enable us to say that disease was the cause. Besides, e history of the case during life would materially assist us in our judgment. e great risk in all these cases is, that the effects of disease may be mistaken r those of poisoning; for we are not likely to mistake a perforation caused irritant poison for the result of disease. Notwithstanding the well-marked fferences above described, it is common to meet with cases of imputed isoning where death has really occurred from peritonitis following perfora- on. I have been required to examine several cases of this kind: one of em will be found elsewhere recorded. ('Guy's Hosp. Reports,' Oct. 1850, ge 226.) In another the body was exhumed after several months' burial, d the stomach was found perforated from disease in the usual situation.

Spontaneous or Gelatinized Perforation.—The stomach is occasionally bject to a spontaneous change, by which its coats are softened, and give y generally at the cardiac or greater end. As the effusion of the contents the organ in such a case never gives rise to peritoneal inflammation, and symptoms occur prior to death to indicate the existence of so extensive a struction of parts, it is presumed to be a change in the dead body, and the ats of the stomach are supposed to undergo a process of solution or diges- n. It is commonly attributed to the solvent action of the gastric juice, spleen, diaphragm, and other viscera being sometimes softened. My league, Dr. Wilks, who has for many years conducted the inspections at y's Hospital, informs me that this post-mortem or cadaveric perforation of stomach is so rare a condition, that it is not met with once in five ndred cases. In the last two cases in which it was observed, one patient d died from albuminuria and the other from head-affection; but in neither these could there be found any peculiarities regarding their food, the e of the last meal, or the state of the bodies to account for the spontaneous struction of the coats of the stomach. (For remarks on this subject by Budd, see 'Med. Gaz.' vol. 39, p. 895.) In January 1845, I met with instance of this perforation in a child between two and three years of age. was seized with convulsions, became insensible, and died twenty-three urs afterwards. After death, the greater end of the stomach was found stroyed to the extent of three inches; and the edges were softened and ckened. There was no food in the stomach, and nothing had passed into the organ for thirty-two hours before death! It was therefore impossible to ascribe death to the perforation, or the perforation to poison. (For a full account of this case, see 'Med. Gaz.' vol. 36, p. 32.) An inspection of the body, with a general history of the case, will commonly suffice to remove any doubt in forming an opinion whether the extensive destruction so commonly met with, has or has not arisen from poison. Thus, in a cadaveric perforation, the aperture is generally situated in that part of the stomach which lies to the left of the cardia; it is very large, of an irregular form, and ragged and pulpy at the edges, which have the appearance of being scraped. The mucous membrane of the stomach is not found inflamed. There is occasionally slight redness, with dark brown or almost black lines (striæ) in and near the dissolved coats, which have an acid reaction. It can only be confounded with perforation by the action of corrosives; but the well-marked symptoms during life, and the detection of the poison after death, together with the changes in the throat and gullet, will at once indicate the perforation produced by corrosive poison. A case of extensive perforation of the stomach, as the result of the action of the gastric fluids, has been reported by Dr. Barnes. (See 'Med. Gaz.' vol. 41, p. 293.)

CHAPTER 11.

RULES TO BE OBSERVED IN INVESTIGATING A CASE OF POISONING—THE INSPECTION OF THE BODY—THE EXHUMATION OF BODIES—IDENTITY OF SUBSTANCES—PRESERVATION OF ARTICLES FOR ANALYSIS—USE OF NOTES—MEDICO-LEGAL REPORTS.

WHEN a practitioner is called to a case of poisoning, it is necessary that he should know to what points he ought to give his attention. It is very proper that every effort should be made by him to save life when the individual is living: but while engaged in one duty, it is also in his power to perform another, supposing the case to be one of suspected criminal poisoning, namely, to note down many circumstances which may tend to detect the perpetrator of a crime. There is no person so well fitted to observe these points as a medical man; but it unfortunately happens, that many facts important as evidence are often overlooked. The necessity for observing and recording them is not perhaps generally known. A medical man need not make himself officious on such occasions, but he would be unmindful of his duty as a member of society, if he did not aid the course of justice by extending his scientific knowledge to the detection of crime. It is much to the credit of the medical profession, that the crime of murder by poisoning, a form of death from which no caution or foresight can protect an individual, is so frequently brought to light, by the announcement of suspicious facts of a medical nature to magistrates and coroners; and on several occasions the highest compliments have been passed by judges on medical practitioners who have been thus indirectly the means of bringing atrocious criminals to the bar of justice.

The following appear to me to be the principal points which demand the attention of a medical jurist in all cases of suspected poisoning: 1. With respect to

SYMPTOMS.

1. The time of their occurrence,—their nature. 2. The exact period at which they were observed to take place after a meal, or after food or medicine had been taken. 3. The order of their occurrence. 4. Whether there was any remission or intermission in their progress, or, whether they continued to become more and more aggravated until death. 5. Whether the patient had laboured under any previous illness. 6. Whether the symptoms were observed to recur more violently after a particular meal, or after any particular kind of

od or medicine. 7. Whether the patient has vomited:—the vomited itters, if any (especially those *first* ejected), should be procured: their odour, lour, and acid or alkaline reaction noted, as well as their quantity. 8. If ne be procurable, and the vomiting has taken place on the dress, furniture, floor of a room,—then a portion of the clothing, sheet, or carpet, may be t out and reserved for analysis;—if the vomiting has occurred on a deal or, a portion of the wood may be scraped or cut out:—or if on a stone vement, then a clean piece of sponge soaked in distilled water may be used remove any traces of the substance. [Some years since, an animal was soned by arsenic. None of the poison could be detected in the stomach, t it was easily found in a portion of deal floor, rendered humid by the uid matters which the animal had vomited during the night.] The vessel which vomited matters have been contained will often furnish valuable dence, since heavy mineral poisons fall to the bottom, or adhere to the es. 9. Endeavour to ascertain the probable nature of the food or medicine taken, and the exact *time* at which it was taken. 10. Ascertain nature of *all* the different articles of food used at a meal. 11. Any sus-ted articles of food, as well as the vomited matters, should be sealed up as n as possible in a clean glass vessel, labelled, and reserved for analysis. Note down, in their own words, all explanations voluntarily made by parties sent, or who are supposed to be concerned in the suspected poisoning. 13. ether more than one person partook of the food or medicine:—if so, ether all these persons were affected, and how? 14. Whether the same d of food or medicine had been taken before by the patient or other persons hout ill effects following. In the event of the *death* of the patient, it will necessary for the practitioner to note down—15. The *exact time* of death, nown, and thus determine how long a period the person has survived after ing been first attacked with the suspicious symptoms. 16. Observe the tude and position of the body. 17. Observe the state of the dress. 18. erve all surrounding objects. Any bottles, paper-packets, weapons, or led liquids lying about should be collected and preserved. 19. Collect any ited matters near the deceased. Observe whether vomiting has taken e in the recumbent position or not. If the person has vomited in the t or sitting posture, the front of the dress will commonly be found covered the vomited matters.

INSPECTION OF THE BODY.

). Note the external appearance of the body, whether the surface is livid allid. 21. Note the state of the countenance. 22. Note all marks of ence on the person, or discomposure of the dress, marks of blood, &c. Observe the presence or absence of warmth or coldness in the legs, s, abdomen, mouth, or armpits. 24. The presence of rigidity or cadaveric n in the body. To give any value to the two last-mentioned characters, necessary for the practitioner to observe the nature of the floor on which body is lying,—whether the body be clothed or naked, young or old, fat naciated. These conditions create a difference, in respect to the cooling of body and the access of rigidity (pp. 5 and 11). 25. If found dead—When the deceased last seen living, or known to have been alive? 26. Note ircumstances leading to a suspicion of suicide or murder. 27. The time death at which the inspection is made. 28. Observe the state of the minal viscera. If the stomach and intestines are found inflamed, the seat flammation should be exactly specified; also all marks of softening, ation, effusion of blood, corrosion, or perforation. The stomach should moved and placed in a *separate vessel*, ligatures being applied to the two

If cut open for examination at this period, this should be performed in a clean dish, and with such care that none of the contents are lost or are allowed to mix with the contents of the intestines. 29. The contents of the stomach, if this organ is opened during the inspection, should be collected in a clean *graduated* vessel:—notice *a*, the quantity; *b*, the odour tried by several persons; *c*, the colour; *d*, acid or alkaline reaction; *e*, presence of blood, mucus, or bile; *f*, presence of undigested food; and here it may be as well to observe, that the presence of farinaceous matters (bread) would be indicated by the addition of iodine water, if the contents were not alkaline—of fat, by heat; *g*, other special characters. 30. The contents of the duodenum should be separately collected, ligatures being applied to it. 31. Observe the state of the large intestines, especially the rectum, and note the condition of their contents. The discovery of hardened fæces in the rectum would prove that purging had not existed recently before death. In one case which I was required to examine, this became a question of considerable importance. 32. The state of the windpipe, throat, and gullet, whether there are in these parts any foreign substances, or marks of inflammation and corrosion. This is of essential importance, as it throws a light upon the question, whether the poison swallowed was irritant or corrosive, and whether it had or had not a local chemical action. It also removes any doubt which might arise respecting death by suffocation from mechanical causes. 33. The state of the lungs and heart; all morbid changes noted. 34. The state of the brain and spinal marrow. 35. The condition of the uterus, ovaries, and genital organs should be examined, as, in the female, poison has been sometimes introduced into the system by the vagina. 36. The liver with the gall bladder should be removed for a chemical examination. 37. The urinary bladder, with any fluid contained in it, should be removed and placed in a separate jar.

Such are the points to which, in the greater number of cases of suspected poisoning, a medical jurist should attend. By means of these data, noted according to the particular case to which they are adapted, he will in general be enabled, without difficulty, to determine the probable time of death, and the actual means by which death was brought about. He may thereby have it in his power also to point out the dish or article of food which had contained the poison, if the case be one of poisoning; and to throw light upon any disputed question of suicide or murder in relation to the deceased. Many cases of poisoning are rendered obscure, owing to these points not having been attended to in the first instance.

I have not considered it necessary to enter into any details respecting the mode of performing an *inspection*. This the practitioner will have acquired during his study of anatomy: and the only essential points in addition to those mentioned are, 1. To examine all the important organs for marks of natural disease: and 2. To note down any unusual pathological appearances, or abnormal deviations; although they may at the time appear to have no bearing on the question of poisoning. It is useful to bear in mind on these occasions, that the body is inspected, not merely to show that the individual has died from poison, but to prove that he has *not* died from any *natural cause*. Medical practitioners commonly give their attention exclusively to the first point; while lawyers, who defend accused parties, very properly direct a most searching examination to the last-mentioned point, i. e. the healthy or unhealthy state of those organs which are essential to life, and with which the poison has not probably come in contact. The usual causes of *sudden death* have their seats commonly in the brain, the heart and its great vessels, or in the lungs. Marks of effusion of blood, congestion, inflammation, suppuration, or a diseased condition of the valves of the heart, should be sought for and accurately noted, whatever may be the condition of the abdominal viscera. It has also been recommended that an examination of the spinal marrow should be ide. If the cause of death be obscure after the general examination of the dy, there is good reason for inspecting the condition of this organ.

Exhumation of Bodies.—Sometimes the inspection of a body is required to made long after interment. So long as the coffin remains entire, there may the expectation of discovering certain kinds of mineral poison in the organs; t decomposition may have advanced so far as to destroy all pathological evince. The inspection in such cases is commonly confined to the abdominal scera. The stomach is often found so thinned and collapsed, that the anterior d posterior walls appear to form only one coat (p. 60). This organ should be moved with the duodenum, and ligatures should be applied to each. The er and the spleen should also be removed, in order that they may, if necesy, be separately analyzed. If poison is not found in one or more of these ts, it is not likely that it will be discovered in the body. It has been recomnded that a portion of earth immediately above and below the coffin should removed for analysis, as it may contain arsenic; but this appears to me to an unnecessary piece of refinement when the coffin is entire, or when the dominal parietes still cover the viscera. If decomposition has so far advanced to have led to an admixture of earth with the viscera, and the poison is nd in minute quantity in the tissues only, the source of the poison may be arded as doubtful. The body of a deceased person, when exhumed, should identified by some friend or relative, in the presence of the medical exiner. In one case of murder by poison, the evidence almost failed, owing his precaution not having been taken.

t is important that the viscera taken from a body which has been long in grave should be sealed up immediately. They should not be allowed to ne in contact with any metal, nor with any surface except that of clean glass, celain, or wood. It has been recommended that they should be washed h chloride of lime, or placed in alcohol; but this is decidedly improper: use of any preservative chemical liquid would not only embarrass the ire analysis, but would render a special examination of an unused portion he liquid necessary, the identity of which would have to be unequivocally blished. Preservation from air in clean glass vessels, with well-fitted ks, covered with skin, or, what is still better, sheet-caoutchouc, is all that equired in practice. There is no objection to the use of a small quantity hloroform. The vapour of this liquid is diffused through the vessel and ls to retard putrefaction. The contents of a stomach, consisting of blood mucus, have thus been preserved in an unchanged state for several ths.

IDENTITY OF SUBSTANCES.

is necessary to observe, that all legal authorities rigorously insist upon f being adduced of the *identity* of the vomited matters or other liquids n from the body of a deceased person, when poisoning is suspected. posing that, during the examination, the stomach and viscera are removed the body, they should never be placed on any surface, or in any vessel, we have first ascertained that the surface or vessel is perfectly *clean.* is point be not attended to, it will be in the power of counsel for the nce to raise a doubt in the minds of the jury, whether the poisonous tance might not have been accidentally present in the vessel used. This be regarded as a very remote presumption; but, nevertheless, it is upon nical objections of this kind that acquittals follow, in spite of the gest presumptions of guilt. This is a question for which every medical ess should be prepared, whether he is giving his evidence at a coroner's est, or in a court of law. Many might feel disposed to regard matters of kind as involving unnecessary nicety and care, but if they are neglected it is possible that a case may be at once stopped: so that the care subsequently bestowed upon a chemical analysis will be labour thrown away. Evidence of the presence of poison in the contents of a stomach was once rejected at a trial for murder, because they had been hastily thrown into a jar borrowed from a neighbouring grocer's shop; and it could not be satisfactorily proved that the jar was clean and entirely free from traces of poison (in which the grocer dealt) when used for this purpose. When the life of a human being is at stake, as in a charge of murder by poisoning, the slightest doubt is always very properly interpreted in favour of the accused.

Not only must clean vessels be used for receiving any liquid destined for subsequent chemical analysis, but care must be taken that the *identity* of a substance is preserved, or the most correct analysis, afterwards made, will be inadmissible as evidence. The suspected substance, when once placed in the hands of a medical man, should never be let out of his sight or custody. It should be kept sealed under his private seal, and locked up while in his possession, in a closet to which no other person has a key. If he has once let it out of his hands, and allowed it to pass through the hands of several other persons, then he complicates the evidence for the prosecution, by rendering it indispensable for these persons to state under what circumstances it was placed while in their possession. The exposure of a suspected substance on a table, or in a closet or room, to which many have access, may be fatal to its identity; for the chemical evidence, so important in a criminal investigation, will probably be altogether rejected by the Court. A case was tried on the Norfolk circuit, in which an analysis of certain matters vomited by a person poisoned with arsenic, was not admitted as evidence against the prisoner, because the practitioner had left them in the custody of two women; and these women had allowed the vessel containing the suspected liquid (which was proved to contain arsenic) to be exposed in a room open to the access of many persons. In another case, tried at the Old Bailey Sessions in 1835, the analysis of some suspected liquids was not allowed in evidence, because the practitioner, who lived in the country, and was unwilling to take the responsibility of analysing them, had sent them up to town by a carrier to be examined by a London chemist. If closely sealed by a private seal, and this is observed by the receiver to be unbroken, before he proceeds to an analysis, this mode of transmission will not probably be objected to. When any article (e. g. a stomach or other organ) is reserved for analysis, care should be taken to attach immediately to it, or to the vessel containing it, a parchment or wooden label, upon which is plainly written, in ink, the name of the deceased and the date of removal, including the day of the week and month. This is especially necessary when there are two or more articles for analysis. I have known the greatest inconvenience to result from the neglect of this simple precaution.

Preserving articles for Analysis.—In removing viscera or liquids from the body, and reserving them for analysis, it is necessary to observe certain precautions. A clean vessel with a wide mouth should be selected; it should be only sufficiently large to hold the organ or liquid (the less air remaining in it the better); it should be secured by a closely fitting cork, covered with fine skin or bladder. Another piece of skin should then be tied over the mouth, or, for this, sheet caoutchouc or gutta percha may be substituted with advantage. It should lastly be covered with tinfoil, and a layer of white leather. In this way any loss by evaporation or decomposition is prevented, and the viscera may be preserved (in a cool place) for some time. If the mouth of the vessel be too wide for a cork, the other articles cannot be dispensed with. Paper only should not be used: I have known the appearances after death of the viscera of an infant, suspected to have died from poison, entirely destroyed by drying, m the evaporation which took place through the layers of paper with which e vessel in which they were contained, was covered. The practitioner ould bear in mind that all these matters are likely to come out in evidence; d whatever is worth doing at all, is worth doing well. For reasons eady stated, antiseptic chemical compounds should not be used. The dition of a small quantity of chloroform to the viscera will, without mplicating the analysis, tend to preserve them.

The articles used for the preservation of viscera should be in all cases upulously examined. Some kinds of calico are dressed with arsenic and ch paste, and many kinds of wrapping-paper as well as wall-papers are ongly impregnated with this poison. An observation made by Mr. Aickin, Belfast, shows that this is not an unnecessary caution. This gentleman s engaged in examining the body of a child, in order to determine the use of death. The organs were healthy, and as no sufficient cause presented elf, he removed the stomach with a view of making an analysis of its tents. He was suddenly called away; and, to preserve the stomach, he apped it in a piece of paper (used for papering rooms), placing it on the coloured side, and he locked it in a closet until the following day. Assisted a friend, he then analysed the contents, and found a trace of morphia with retty large quantity of arsenic. As the symptoms from which the child l died were not those of poisoning by arsenic, and there were no appear-es of the action of arsenic on the body, he came to the conclusion that re must be some extraneous cause to account for the presence of this son. He examined a portion of the wall-paper in which the stomach had n wrapped, and then found that that part of it which was coloured yellow tinted with sulphide of arsenic or orpiment! It was therefore evident, as iment contains white arsenic, that the stomach and its contents had ibed a portion of the poison during the night. ('Lancet,' June 23, 1855, 32.) This satisfactorily accounted for the presence of arsenic, under umstances which might have given rise to a false charge of murder. rly all wall-papers, having any tinge of green or golden yellow in them, tain arsenic, and this arsenic spreads by imbibition to other parts of the er not so tinted. It would, of course, be proper to avoid in all cases the of any wrapper having upon it mineral colours of any description. Aickin's case shows in a striking point of view the danger of trusting to nical analysis alone. Unless we look to physiology and pathology, a t erroneous opinion may be expressed.

rsenic is sometimes found mixed with oxide of iron in ochreous deposits oils. It is thus occasionally present in the soil of cemeteries, but in an luble form. Even in the fur deposited in tea-kettles, in which there is rally some oxide of iron, arsenic has been found in an insoluble form. n about a pound and a half of the crust or fur of a vessel used for ng water, Otto obtained well-marked arsenical deposits. Pöllnitz has cted in the fur of kettles—copper, lead, tin, and even antimony. Osborn, of Southampton, has confirmed Pöllnitz's conclusion, namely, lead is present in an insoluble form in the deposits of kettles and boilers. ed. Times and Gaz.' Dec. 22, 1860, p. 608.) Otto discovered a much er proportion of arsenic in the calcareous crust taken from a kitchen er. Ten ounces of this gave a deposit of arsenic in a glass tube, and ral stains on porcelain. He thinks that, if a sufficient quantity is loyed, arsenic will be found in all spring and well-waters. ('Ausmittelung ifte,' 1856, p. 61.) I have found arsenic in the water of rivers used for supply of towns, and have extracted a well-marked quantity from two es of the dried mud of the Thames, as well as from similar quantities of taken from three churchyards in the north of England. ('Guy's Hosp.

Reports,' Oct. 1860. On Arsenic and Antimony.) These facts, if they prove anything, tend to show the extreme danger of placing reliance on minute chemical results in the absence of good physiological and pathological evidence.

The results of an analysis, in the shape of sublimates or precipitates, should be preserved as evidence, distinctly labelled in small glass-tubes hermetically sealed. They can then, if asked for, be produced for examination at the inquest or trial.

On the Use of Notes.—It has already been recommended, as a rule in these criminal investigations, that a practitioner should make notes of what he observes in regard to symptoms, appearances after death, and the results of a chemical analysis. His own observations should be kept distinct from infornation given to him by others. He may base his conclusions on the former, but not on the latter. From the common forms of law in this country, a person charged with the crime of poisoning may remain imprisoned, if at a distance from the metropolis, for some months before he is brought to trial. It is obvious, however clear the circumstances may at the time appear to a practitioner, that it will require more than ordinary powers of memory to retain, for so long a period, a distinct recollection of all the facts of the case. If he is unprovided with notes, and his memory is defective, then the case will turn in favour of the prisoner, for he will be the person to benefit by the neglect of the witness. In adopting the plan here recommended, such a result may be easily prevented. It may be remarked that the law relative to the admissibility of notes or memoranda in evidence is very strict, and, in trials for murder, is rigorously enforced by the judges. In order to render such notes or memoranda admissible, it is indispensably necessary that they should be taken on the spot at the time the observations are made, or as soon afterwards as practicable; and, further, it must be remembered that a witness can refer to them only for the purpose of refreshing his memory.

Medico-legal Reports.—One of the duties of a medical jurist is to draw up a report of the results of his examination: 1, in regard to symptoms; 2, in regard to appearances after death; and, 3, in regard to the results of an analysis. With respect to the two first divisions of the report, I must refer the reader to the rules for investigating cases of poisoning (p. 152). It need hardly be observed that the time at which the person was first seen, and the circumstances under which the attendance of the practitioner was required, as well as the period of death, should be particularly stated. The hour, the day of the week, and the month, should be invariably mentioned. Some medical witnesses merely state the day of the week, without that of the month, or vice versâ. At a trial this sometimes creates great confusion, by rendering a reference to almanacs necessary. The words yesterday, next day, &c., should never be used. The facts which it will be necessary to enter in the report are specially stated under the heads of investigation (see p. 153.) If these facts are not observed in the order there set down, their value as evidence of the cause of death, or of the criminality or innocence of particular parties, will be entirely lost. In drawing up a report of symptoms and appearances after death, the facts should be in the first instance plainly and concisely stated *seriatim*, in language easily intelligible to non-professional persons. A reporter is not called upon to display his erudition, but to make himself understood. If technical terms are employed, their meaning should be stated in parentheses. When a subject is thoroughly understood, there can be no difficulty in rendering it in simple language; and when it is not well understood, the practitioner is not in a position to make any report. Magistrates, coroners, and barristers are very acute, and easily detect ignorance, even when it appears under the mask of erudition.

In recording facts a reporter should not encumber his statements with
nions, inferences, or comments. The facts should be first stated and the
clusions should be reserved until the end of the report. The language in
ich conclusions are expressed, should be precise and clear. It must be re-
mbered that these are intended to form a concise summary of the whole
port, upon which the judgment of a magistrate, or the decision of a coro-
's jury, will be ultimately based. They should be most strictly confined to
matters which are the subject of inquiry, and which have actually fallen
ler the observation of the witness. Thus, they commonly refer to the fol-
ng questions:—What was the cause of death? What are the medical
umstances which lead you to suppose that death was caused by poison?
at are the circumstances which lead you to suppose that death was *not*
sed by natural disease? Answers to one or all of these questions comprise,
general, all that a reporter is required to introduce into the conclusions of
report.

he reporter must remember that his conclusions are to be based only upon
ical facts,—not upon moral circumstances, unless he is specially required
xpress his opinion with regard to them when they are of a medico-moral
ure. Further, they must be founded only on what *he has himself seen or*
rved. Any information derived from others, should not be made the basis
n opinion in a medico-legal report. It is scarcely necessary to remark
a conclusion based upon mere *probabilities* is of no value as evidence.

n drawing up a report on the *results of a chemical analysis*, the following
s may be borne in mind. A liquid or solid is received for analysis. 1.
en, and of whom, or how received? 2. In what state was it received—
red in any way, or exposed? 3. If more than one substance received,
to be separately and distinctly labelled; appearance of the vessel, its capa-
and the quantity of liquid (by measure) or solid (by weight) contained
ein. 4. Where and when did you proceed to make the analysis, and
re was the substance kept during the intermediate period? 5. Did any
ssist you, or did you make the analysis yourself? 6. Physical characters
e substance. 7. Processes and tests employed for determining whether it
ined poison. All the steps of these processes need not be described;—
eral outline of the analysis will suffice. The magistrate may thus satisfy
elf by an appeal to others (if necessary) whether the analysis has or has
een properly made. 8. Supposing the substance to contain poison—is
in a pure state or mixed with any other body? 9. The strength of the
n, if an acid, or if it be in solution: in *all* cases, the *quantity* of poison
d, determined if possible by actual weighing. 10. Supposing no poison
contained in it, what was the nature of the substance? Did it contain
ing of a noxious nature, i. e. likely to injure health or destroy life? 11.
d the supposed poisonous substance exist naturally or be produced within
ody? 12. Was it present in any of the liquids or solids employed in the
ical analysis? 13. Was it contained in any of the articles of food or
cine taken by the deceased? 14. Is its presence to be ascribed to the use
y mineral matter employed by injection after death for the preservation
e body of the deceased? 15. What quantity of poison was actually
ated in the free or absorbed state? 16. How much of the substance
would, under the circumstances, be likely to destroy life?

ere are few reports in which answers to many of these questions, although
rmally put, will not be required; and unless the whole of them are borne
nd by the operator at the time an analysis is undertaken, those which are
ed can never receive an answer, however important to the ends of justice
nswer may ultimately become.

IRRITANT POISONS.

CHAPTER 12.

SULPHURIC ACID OR OIL OF VITRIOL. SYMPTOMS—APPEARANCES AFTER DEATH—FATAL DOSE—PERIOD AT WHICH DEATH TAKES PLACE—MODE OF DETECTING THE POISON IN PURE AND MIXED LIQUIDS—IN ARTICLES OF CLOTHING.

SULPHURIC ACID, OR OIL OF VITRIOL. SULPHATE OF INDIGO.

Symptoms.—When this poison is swallowed in a concentrated form, the symptoms produced, come on either *immediately*, or during the act of swallowing. There is violent burning pain, extending through the throat and gullet to the stomach, and the pain is often so severe that the body is bent. There is an escape of gaseous and frothy matter, followed by retching and vomiting, the latter accompanied by the discharge of shreds of tough mucus and of a liquid of a dark coffee-ground colour, mixed with blood. The mouth is excoriated, the lining membrane and surface of the tongue white, or resembling soaked parchment; in one instance the appearance of the mouth was as if it had been smeared with white paint. After a time, the membrane acquires a grey or brownish colour; the mouth is filled with a thick viscid substance consisting of saliva, mucus, and the corroded membrane: this renders speaking and swallowing difficult. If the poison has been administered by a spoon, or the phial containing it has been passed to the back of the throat, the mouth may escape the chemical action of the acid. A medical witness must bear this circumstance in mind, when he is called to examine an infant suspected to have been poisoned by sulphuric acid. Around the lips and on the neck may be found spots of a brown colour from the spilling of the acid and its action on the skin. There is great difficulty of breathing, owing to the swelling and excoriation of the throat and larynx, and the countenance has from this cause, a bluish or livid appearance; the least motion of the abdominal muscles is attended with increase of pain. These symptoms, although characteristic of the action of a corrosive liquid, have been sometimes mistaken for those of disease. ('Henke, Zeitschrift der S. A.' 1843, 2, 284.) The stomach is so irritable, that whatever is swallowed is immediately ejected, and the vomiting is commonly violent and incessant. In a case reported by Dr. Geoghegan, of Dublin, the patient (a female) vomited for three or four hours. This symptom then ceased, and did not recur, although the woman did not die until thirty-four hours after the poison had been swallowed. ('Med. Gaz.' Vol. 48, p. 328.) The matters *first* vomited generally contain the poison: they are acid, and if they fall on a limestone pavement there is effervescence; if on coloured articles of dress, the colour is sometimes altered to a red or yellow, or it is entirely discharged and the texture of the stuff destroyed; on a black cloth dress, the spots produced by the concentrated acid are reddish brown, and remain moist for a considerable time. An attention to these circumstances may often lead to a suspicion of the real cause of the symptoms, when the facts are concealed. After a time there is great exhaustion, accompanied by great weakness; the pulse becomes quick, small, and feeble; the skin cold, mottled, and covered with a clammy sweat. There is generally great thirst, with obstinate constipation of the bowels; should any evacuations take place, they are commonly either of a dark brown or leaden colour, in some instances almost black arising from an admixture of altered blood. There are sometimes convulsive motions of the muscles, especially those of the face and lips. The untenance, if not livid from obstructed respiration, is pale, expressive of eat anxiety and intense suffering. The intellectual faculties are quite clear, d death usually takes place very suddenly, in from eighteen to twenty-four urs after the poison has been taken.

Appearances after Death.—The marked effects of this poison are not always served in the stomach; they may be confined to the region of the throat and ndpipe. In an inspection of the body, the whole course of the alimentary nal from the mouth downwards, should be examined; since in recent or ute cases it is in the throat and gullet, that we generally obtain strong idence of the action of a corrosive poison. The discovery of the usual rks of corrosion in these parts, is always highly corroborative of the signs poisoning found in the stomach. During the inspection, the examiner ist not omit to notice any spots on the skin produced by the action of the d: these are commonly of a dark brown colour, and are situated about the uth, lips, and neck. The appearances met with in the body vary, accord- to whether death has taken place rapidly or slowly. Supposing the case have proved rapidly fatal, the membrane lining the mouth may be found ite, softened, and corroded. The mucous membrane of the throat and llet is commonly found corroded, having a brown-black, or ash-grey colour, l blood is effused in patches beneath it. The corroded membrane of the llet is occasionally disposed in longitudinal folds, portions of it being partly ached. The *stomach*, if not perforated, is collapsed and contracted. On ing it open, the contents are commonly found of a dark brown or black our and of a tarry consistency, being formed in great part of mucus and ered blood. The contents may or may not be acid, according to the time patient has survived, and the treatment which has been adopted. On re- ving them, the stomach may be seen traversed by black lines, or the whole the mucous membrane may be corrugated, and stained black or of a dark wn colour. This blackness is not entirely removed by washing. On tching the stomach, traces of inflammation may be found between the ls, indicated by a dark crimson red colour. On forcibly removing the ckened membrane, the red colour indicative of inflammation may be seen he parts beneath. Both the dark colour and marks of inflammation are etimes partial, being confined to isolated portions or patches of the mucous nbrane. When the stomach is perforated, the coats are softened, and the edge he aperture is commonly black and irregular. In removing the stomach, opening is liable to be made larger by the mere weight of the organ. contents do not always escape; but when this happens, the surrounding s are attacked by the poison. In a case which occurred at Guy's Hospi- the spleen, the liver, and the coats of the aorta, were found blackened and oded by the acid, which had escaped through the perforation. When a on has survived for eighteen or twenty hours, traces of corrosive and in- matory action may be found in the small intestines. In one case the ous membrane of the ileum was corroded. The interior of the windpipe ell as of the bronchial tubes, has also presented marks of the local action ie acid. The acid has thus destroyed life without reaching the stomach. markable instance in which the poison penetrated into and destroyed lungs has been reported by Dr. Gull. (See 'Med. Gaz.' vol. 45, p. 1102.) important for a medical witness to bear in mind, that the mouth, throat, gullet are not always found in the state above described. Dr. Ogle met a case in which the membrane of the tongue was but slightly affected. man had swallowed a large dose of the acid and had died in nine hours. l. Times and Gazette, April 21, 1860.) Strange as it may appear, cases recorded in which, notwithstanding the introduction of this poison into tomach, the gullet has escaped its chemical action. Mr. Dickinson has reported a case of poisoning by sulphuric acid in which there was no corrosion of the mouth and throat. The patient, a female, æt. 52, recovered in about five months. The stomach had probably sustained injury, as the most urgent symptoms were constant vomiting after taking food, and obstinate constipation. The quantity of acid swallowed was half an ounce, mixed with half an ounce of water. The patient felt *immediately* a burning sensation at the pit of the stomach ('Lancet,' Nov. 26, 1853, p. 502). The acid had here evidently lost its corrosive power by dilution. (See 'ON POISONS—*Sulphuric Acid*,' p. 253.) When the acid has been taken in a still more *diluted* state, the marks of inflammation on the mucous membrane are less decided, and the blackening is not so considerable. Nevertheless, the acid, unless too much diluted, acts upon and darkens the blood in the vessels, as well as that contained in the stomach, although it may not blacken the mucous membrane or the contents.

Dr. Walker, of Inverness, met with a case in which a man, æt. thirty, swallowed fifteen drachms and a half of sulphuric acid (sp. gr. 1·842), and died twenty-five hours afterwards. Half an hour after taking the poison he resembled a patient in the collapsed stage of cholera. The inside of the lips, as well as the tongue and throat, were swollen, and had the appearance of being smeared with thin arrow-root. He suffered severe pain, but did not vomit until *three-quarters of an hour* had elapsed: the vomiting appeared to be then excited by the liquid which had been given to him. The vomited matters were dark, bloody and viscid. The patient was sensible up to the time of his death. An inspection revealed the usual appearances. The mucous membrane of the stomach was destroyed, and the whole surface was darkened. The greatest amount of injury was at the pyloric end, where three small perforations were found. The orifice of the pylorus was swollen, constricted, and hardened; it was so small as to admit only a silver probe. The duodenum had also suffered. The first two inches of the arch of the aorta were much inflamed. There were no traces of the acid in the stomach; there was a slight trace in the duodenum; a trace in the serous fluid at the base of the brain; but the largest quantity was found in the blood contained in the heart. ('Edin. Monthly Jour.' June, 1850, p. 538.) This case is remarkable in the fact that vomiting was not immediate; that there were no spots on the outside of the face; that the poison was swallowed in large quantity on an empty stomach; and there was free voluntary exertion, as, twenty hours after he had taken the poison, the man got out of bed and sat on a night-stool. Dr. Geoghegan, of Dublin, has published in the London 'Medical Gazette' (vol. 48, p. 328), a full account of the symptoms and appearances after death in a well-marked case of poisoning by sulphuric acid, as well as of a process for detecting this poison when absorbed.

Quantity required to destroy Life.—The dangerous effects of the acid appear to arise rather from its degree of concentration, than from the absolute quantity taken. The quantity actually required to prove fatal, must depend on many circumstances. If the stomach is full when the poison is swallowed, the action of the acid may be spent on the food and not on the stomach; and a larger quantity might then be taken than would suffice to destroy life if the organ were empty. The smallest quantity which is described as having proved fatal was in the following case:—Half a tea-spoonful of concentrated sulphuric acid was given to a child about a year old by mistake for castor oil. The usual symptoms came on, with great disturbance of breathing; and the child died in twenty-four hours. The quantity here taken could not have exceeded *forty drops*. (Med. Gaz. vol. 29, p. 147.) It is, however, doubtful whether this small quantity would have proved fatal to an adult. The smallest fatal dose which Dr. Christison states he has found recorded, is *one* *chm*; it was taken by mistake by a stout young man, and killed him in en days. (Op. cit. 162.) Even when diluted, it will destroy life rapidly. man swallowed, on an empty stomach, six drachms of the strongest acid uted with eighteen drachms of water. He suffered from the usual symps, and died in two hours and a half. ('Med. Times and Gaz.' 1863, . 1, p. 183.)

Period at which Death takes place.—It has been already stated, that the rage period at which death takes place in cases of acute poisoning by phuric acid, is from eighteen to twenty-four hours. When the stomach is forated by the acid, it commonly proves more speedily fatal. In one ince, reported by Dr. Sinclair, a child about four years old died in four rs: the stomach was found perforated. When the poison acts upon the dpipe, death may be a still more speedy consequence, from suffocation; and, ng to this, it appears to be more rapidly fatal to children than adults. Craigie mentions a case in which three ounces of concentrated sulphuric l destroyed life in three hours and a half. Remer met with an instance in ch death took place in *two hours.* A case is reported by Mr. Watson, in ch a woman swallowed two ounces of the strong acid. She died in *half hour*, but it appears that a quarter of an hour before death, she had made ep wound in her throat, which gave rise to great bleeding. The stomach found extensively perforated: but it is highly probable that the wound lerated death in this case. The shortest case recorded, occurred to M. p. A man, æt. fifty, swallowed three ounces and a half of concentrated huric acid. He died in *three-quarters of an hour.* ('Gazette Medicale,' 28, 1850.) On the other hand, there are numerous instances reported hich the poison proved fatal from secondary causes, at periods varying one week to several months.

hemical Analysis.—This acid may be met with either concentrated or ed; and a medical jurist may have to examine it under three conditions: In its simple state.—2. When mixed with organic matters, as with liquid les of food, or in the contents of the stomach.—3. On solid organic sub-es, as where the acid has been thrown or spilled on articles of dress or ing.

the simple state. If *concentrated*, it possesses these properties: 1. d, sugar, or other organic matter plunged into it, is speedily carbonized iarred, either with or without the application of heat. 2. When boiled wood, copper-cuttings, or mercury, it evolves fumes of sulphurous acid; is immediately known by the odour, as well as by the acid vapour first ring blue, and then bleaching, starch-paper dipped in a solution of iodic 3. When mixed with an equal bulk of water, great heat is evolved— y 200° F., in a cold vessel.

e diluted Acid. For the acid in a diluted state, but one test may be ap-: this is a solution of a salt of baryta, either the *nitrate of baryta*, or the *de of barium.* Having ascertained by test-paper that the liquid is acid, ld to a portion of it a few drops of nitric acid, and then a solution of e of baryta. If sulphuric acid is present, a dense white precipitate of ate of baryta will fall down: this is insoluble in all acids and alkalies. precipitate is collected, dried, and heated to redness in a small platinum ble, or in a folded piece of platinum foil, with five or six parts of charcoal r, it will, if a sulphate, be converted into sulphide of barium. To prove ve add to the calcined residue, hydrochloric acid, at the same time sus-ng over it a slip of filtering paper moistened with a solution of acetate d, or, what is more convenient, we place the residue on a slip of glazed coated with carbonate of lead), scraped and wetted on the surface. ard should be first tested for lead, because some kinds of glazed cards are made without lead.) If the original precipitate was a sulphate, the gas evolved, will be sulphuretted hydrogen, known by its odour, and by its turning the salt of lead, or staining the card of a brown colour. If some of the powder is dropped into a solution of nitroprusside of sodium, this liquid acquires a rich purple colour. The smallest visible quantity of sulphate of baryta thus easily admits of detection.

The ferrocyanide of potassium may be substituted for charcoal in the proportion of one part of ferrocyanide to three or four parts of sulphate of baryta. The mixture may be heated to redness either in a reduction-tube by a spirit lamp, or in a small porcelain crucible, covered with a layer of mica: it speedily blackens and fuses. The fused residue when cooled, may be proved to contain sulphide of barium. On the addition of hydrochloric acid, sulphuretted hydrogen gas is set free, a fact which may be demonstrated by the use of lead-paper as well as by the odour. The gas is mixed with some hydrocyanic acid vapour. If a reduction-tube has been used, the fused mass may be separated by filing off the end of the tube containing it. The mass reduced to powder and placed on a glazed card wetted with distilled water, produces a brown stain of sulphide of lead. Some fragments placed in a glass containing a solution of nitroprusside of sodium, will impart to the liquid a rich purple colour if a sulphide is present. A portion of the mixture of sulphate and ferrocyanide may be heated on a stout platinum wire, in the reduction-flame of a spirit-lamp or of a Bunsen's jet. If the wire with the fused mass is then placed on a glazed card moistened with a drop of water, a brown stain of sulphide of lead is immediately produced. This simple experiment renders a crucible or reduction-tube unnecessary. The ferrocyanide effects the conversion of the sulphate into sulphide, more speedily and at a lower temperature than charcoal.

In a medico-legal analysis it may be desirable to heat an equal portion of the ferrocyanide alone, and test the fused residue in the manner described, in order to remove any objection arising from the alleged presence of an alkaline sulphate as impurity.

Diluted sulphuric acid does not carbonize organic substances which are immersed in it. The application of heat will only effect carbonization when the water of the acid is entirely evaporated. Thus, paper wetted with the diluted acid, becomes charred when dried and heated. This may serve as a method of identification in the absence of tests.

In Liquids containing organic Matter.—If sulphuric acid is mixed with such liquids as porter, coffee, or tea, the process for its detection is substantially the same, the liquid being first rendered clear by filtration. The precipitated sulphate of baryta, if mixed with organic matter, may be purified by boiling it in strong nitric acid; but this is not commonly necessary, as the reduction of the dried precipitate may be equally well performed with the impure, as with the pure sulphate. Some liquids, such as vinegar, porter, and most wines, generally contain sulphuric acid or a sulphate, but the acid is in small proportion; therefore, if there is an abundant precipitate, there can be no doubt, *cæteris paribus*, that free sulphuric acid has been added to them. Should the liquid be thick and viscid like gruel, it may be diluted with water, and then boiled with the addition of a little acetic acid. For the action of the barytic test, it is not necessary that the liquid should be absolutely clear, provided it is not so thick as to interfere mechanically with the precipitation of the sulphate of baryta. So far with regard to articles administered, or of which the administration has been attempted. A similar process may be applied to the examination of matters *vomited* and of the *contents of the stomach*, care being taken to separate the insoluble parts by filtration, before adding the test. The coats of the stomach should be cut up and then boiled in distilled water for some time for the perfect extraction of the acid.

t is a medico-legal fact of considerable importance, that the contents of a nach in a case of poisoning by sulphuric acid, are sometimes entirely free n any traces of this poison, even when it has been swallowed in large ntity. The acid is not commonly found when the individual has been ler treatment, when there has been considerable vomiting, aided by the king of water or other simple liquids, or when the person has survived ral days. If the case has been under treatment, the acid is either wholly ent or neutralized by antidotes. A girl swallowed four or five ounces of ted vitriol, and died in eighteen hours. No portion of the acid could be cted in the stomach; but she had vomited considerably, and the acid was y proved to exist in the vomited matters, by examining a portion of the t of a bed which had become wetted by them. In another case, nearly ounces of the concentrated acid were swallowed; the patient died in nty-five hours; the stomach was extensively acted on, and yet no trace he acid could be discovered in the contents. The liquidity of the on, and the facility with which it becomes mixed with other liquids and ted by vomiting, will readily furnish an explanation of this fact. In y cases of poisoning by sulphuric acid, therefore, a medical witness must repared to find, that chemical analysis will furnish only negative results. , however, is not inconsistent with death having taken place from the on. The facts are so conclusive on this point, that I should not have ght it necessary to add to the evidence accumulated on the subject, but an erroneous statement has been put prominently before the public that erson can die from poison, except the poison be found in the body. er has dealt with this question. He relates three cases of poisoning by uric acid, which occurred to himself, one which proved fatal in eight days ond in five days, and a third in three days. In not one instance could ce of the poison be found. (Handb. der Ger. Med. i. vol. 1, p. 421, 429.) e second case two tablespoonfuls were swallowed by a girl. The analysis led merely the accidental presence of a fractional part of a grain kaline sulphate in the stomach and bowels. Thus there was an entire e of proof from chemistry, while the facts of the case, and the appearances e body, established conclusively that death had really been caused ulphuric acid. In one instance, in which death took place on the nth day, I found no trace of sulphuric acid in the body. If the stomach d be perforated, the contents will be found in the abdomen, or perhaps e lower part of the cavity of the pelvis: they may then be collected, l with distilled water, and the solution examined for the acid by the ss already described. If the contents of the stomach are highly putrefied lphuric acid may be found combined with ammonia.

chemical analysis not only aids a medical jurist to point out a criminal: etimes tends to show in a conclusive manner that an accused person is y be innocent. In *Reg.* v. *Hartley* (Central Criminal Court, May 1850), risoner, a girl, was charged with attempting to administer oil of vitriol fee to her father. The prisoner usually made the coffee for breakfast, ould then have had an opportunity of adding it to the liquid. It might er, have been mixed with the coffee in the cup after it had been poured and, in this case, other persons had had the opportunity of poisoning ffee. This question was solved by the aid of chemistry. I procured ffee-pot, and found that it was old and rusty; the poisoned coffee was and it contained no trace of iron, but on warming a small quantity acid coffee in the pot, it was immediately and strongly impregnated sulphate of iron. It was therefore clear that the acid had not been with the coffee in the pot, and might have afterwards been put into the ithout the knowledge of the prisoner. Numerous other cases will suggest themselves in which a guilty person may be detected, and an innocent person protected, by the aid of a chemical analysis of the poisoned liquid.

In *Reg.* v. *North* (Guildford Summer Assizes, 1846) the proof of administration rested in part on the carbonizing action of oil of vitriol on sugar. *Mary North* was charged with the murder of an infant by giving to it oil of vitriol. The deceased had died from the effects of the poison; therefore the only part of the case which created difficulty was the proof of administration. The mother of the deceased, wishing to give the child some aniseed-spirit and water, placed a lump of sugar in a white cup, and added a tea-spoonful of the spirit; she then went to another apartment, and poured from a kettle about a tea-spoonful of water. She observed no particular appearance in the mixture; she *tasted* it, there was no hot or acid taste, there was no blackening or change of colour; she then gave the mixture to the infant, while a little girl who was present drank up the dregs, and suffered no ill effects. The prisoner was present, and in about half a minute took the child. After the child had taken this liquid, there were no symptoms or effects to attract attention, and it appeared relieved of the wind from which it had suffered. The mother left the room, and the prisoner then took the infant into an adjoining pantry, in which it was sworn there was a bottle of vitriol, put there by the prisoner. In about a minute and a half or two minutes, the mother, owing to a noise which she heard, returned to the room, and found her infant evidently writhing in great pain, and its mouth covered with a whitish froth. The prisoner, while bringing the child from the pantry into the kitchen, was, according to one witness, in the act of wiping its mouth with a napkin, on which sulphuric acid was found. Medical assistance was immediately sent for; but in spite of treatment the child died. The defence was, that the mother herself had made a mistake, and had given a tea-spoonful of oil of vitriol to her infant in place of aniseed; but that was chemically impossible under the circumstances, as the child who drank the dregs of the mixture did not suffer, and the mixture could not have been made as described by the mother, without *blackening the sugar*. In spite of these obvious conclusions, the jury acquitted the prisoner; but the medical and chemical facts of the case clearly proved that the mother could not have made the mistake suggested. (See 'Guy's Hospital Reports,' vol. 4, p. 396.)

On solid organic Substances. It sometimes happens in cases of poisoning by sulphuric acid that it is spilled upon articles of clothing, such as cloth or linen, and here a medical jurist may succeed in detecting it, when every other source of chemical evidence fails. Again sulphuric acid is often used for the purpose of seriously injuring a party, as by throwing it on the person, an offence which, when accompanied with bodily injury, renders the offender liable to a severe punishment. On such occasions, proof of the corrosive nature of the liquid is required; and this is easily obtained by a chemical examination of a part of the dress. The process of analysis is very simple. The cloth should be digested in a small quantity of distilled water at a gentle heat, whereby a brownish coloured liquid may be obtained on filtration. If sulphuric acid is present, the liquid will have an acid reaction, and produce the usual effects with the barytic test. Old stains are known by the complete destruction of the organic fibre: fresh stains by their dampness. The acid remains fixed in the stuff. I have thus detected it after the long period of twenty-seven years.

The detection of spots of this acid on clothing, has in some cases served to supply the place of direct evidence from a chemical analysis of the stomach; and in other instances it has aided justice in fixing on an accused person, the act of administration. *Jean Aitkin*, or *Humphreys*, was tried at the Aberdeen September Circuit, 1830, for the murder of her husband, by pouring sulphuric acid down his throat as he lay asleep in bed. The parties frequently quarrelled, nd were both addicted to habits of intoxication. On the night in question, ome friends had passed the evening with them, drinking. They left the house bout twelve o'clock at night, and soon after this, the deceased was seen asleep bed. The only persons in the house at this time were the prisoner and a rvant-maid, and the street door was locked, so that no other person could ave had access. The prisoner left the servant's room on her stocking-soles, thing unusual for her, and when she returned in about twenty minutes, she ld the servant that her husband was roaring mad with drink. The girl, pon going to him, found him lying upon his back, declaring that he was all asting. The prisoner at first showed an unwillingness to send for a medical an, but at length did so. When the deceased left his guests at twelve, there ere only two glasses on the table in the room; but when the neighbours me in after the alarm, there were *three*, and the third was proved to have me from a room above stairs, of which the prisoner had the key. This glass ntained, it was supposed, sulphuric acid. In the room where the deceased as lying there was a phial which had contained sulphuric acid, but it was en nearly empty. The deceased lived two days, but never could give any rther account of the matter than that he went to sleep quite well, and awoke ll roasting,' and had suffered the utmost agony ever since. He evidently ed from the effects of sulphuric acid, large quantities of which were detected his shirt, on the blanket and bedcover, and a little on the prisoner's bed- wn and handkerchief; but not a trace of the poison could be discovered in e stomach or intestines of the deceased. (Alison, 'Criminal Law of Scot- nd,' p. 75; also 'Medical Gazette,' vol. 8, p. 77.) In the defence, it was eged that the deceased had voluntarily taken the poison and committed icide; but the only time at which he could by any possibility have taken it, s when he was drinking with his friends; for immediately after they left, went to bed, and was seen asleep; and, according to his own account, he oke suddenly with the pain and other symptoms produced by this poison. was impossible that he could have swallowed the acid while drinking with friends; for the symptoms of the corrosives come on *suddenly*, and cannot suspended; therefore the poison must have been poured down his throat ile he was sleeping, and as the house was at that time fastened up, this act ld only have been perpetrated by the prisoner or the maid-servant. The cumstances above mentioned clearly showed that the prisoner was the guilty ty.

The case of *Catherine Wilson* (C. C. C. June 1862) presents some features interest in this respect. The prisoner acted as nurse to the prosecutrix, was at the same time secretly cohabiting with her husband. She pro- ed a black draught at a druggist's, and administered it to the prosecutrix in glass, in which, however, there was strong reason to believe she had viously placed a quantity of oil of vitriol. The prosecutrix felt the glass rm, and on the prisoner pouring more of the liquid (the black draught) it, the warmth so increased, that she told the prisoner she must have led the medicine and she could not drink it. At the persuasion of the soner she took a mouthful, but immediately spat out the liquid, which nt her mouth, and, as it was afterwards found, corroded her dress and the clothes. It was proved that the bottle containing the draught supplied by druggist was cold; and that there was no warmth until after the mixture made in the glass by the prisoner.

wing to some omission on the part of the prosecution, the clothes were not yzed, and there was no chemical evidence of sulphuric acid having been l, except the heat on mixture with a watery draught and the action of the on the bedclothes. These facts, however, with the corrosive action on mouth of the prosecutrix, were quite sufficient to prove medically that sulphuric acid had been administered, although none of the draught or of the acid employed, could be procured for analysis. In the entire absence of direct chemical evidence, the jury were persuaded to acquit the woman. In the following October, the prisoner, who was acquitted of this charge, was convicted and executed for poisoning another woman whom she had nursed some time before. She had in a period of ten years acted as nurse to several other persons who had all died under symptoms of poisoning with colchicum!

In the above case, it will be observed, the poison was not swallowed, but this does not affect the criminality of the act. In *Reg.* v. *Paxton* (C. C. C. June 1863) Baron Bramwell held that it was not necessary that the poison (sulphuric acid) should be swallowed: it was quite sufficient to constitute the crime, if any portion of it, however small, should have been taken into the mouth.

The importance of analysis applied to articles of clothing was made evident in the case *Reg.* v. *Brown* (Bury St. Edmunds, Lent Assizes, 1864). The deceased, aged three years, was an illegitimate child of the prisoner. It was living with the prisoner's father and mother. On the day of its death, the prisoner came to see the child and was with it alone in a bedroom: in *five minutes* after she had left the room, no other person being present, the child was heard to be sick, and it was found to be suffering from the effects of some corrosive acid. The child died in about nine or ten hours, and the symptoms during life, when it was seen by a medical man, as well as the appearances in the body after death, were clearly those of poisoning by oil of vitriol. Mr. Image detected the acid in vomited matter on the shirt of the child, and on a dress worn by the mother on the occasion of her visit. It was further proved that a bottle of vitriol, kept in a closet of the house where she was servant, was missing. In spite of these strong facts in proof of administration, the jury, under the charge of the judge, Cockburn, C. J., acquitted the prisoner. It was somewhat remarkable that the child did not scream from pain during the act of swallowing, and that attention should not have been called to its condition until after the lapse of five minutes. Still the facts appeared to point to the prisoner only, as the person who administered the poison.

SULPHATE OF INDIGO.

Several cases of accidental poisoning by this liquid have occurred. As the compound is nothing more than a solution of indigo in strong sulphuric acid, the symptoms and appearances after death, are similar to those which have been already described. This kind of poisoning may be suspected when, together with these symptoms, the membrane of the mouth has a blue or blue-black colour. The vomited matters, as well as the fæces, are at first of a deep blue-black tint; afterwards green; and it was observed in two instances that the urine, voided by the patients, had a blue tinge.

It is proper to notice, that as indigo is one of the substances now directed by the statute to be mixed with arsenic when sold in small quantities, the detection of this colouring principle in the mouth and vomited matters will not necessarily show that it has been taken in the form of sulphate.

Analysis.—This solution is of a dark blue colour, and strongly acid. Sulphuric acid is detected in it by the methods above described. The blue colour is discharged by chlorine, or when a portion previously diluted has been boiled with nitric acid.

CHAPTER 13.

SONING BY NITRIC ACID OR AQUA FORTIS—APPEARANCES AFTER DEATH—ROCESSES FOR DETECTING THE POISON IN PURE AND ORGANIC LIQUIDS—OISONING BY HYDROCHLORIC ACID.

RIC ACID is popularly known under the name of Aqua fortis, or Red spirit nitre. According to Tartra, it seems to have been first used as a poison ut the middle of the fifteenth century. Although it is perhaps much more d in the arts than oil of vitriol, cases of poisoning by it are by no means mon.

ymptoms.—When the acid is in a concentrated state, the symptoms, on whole, bear a close resemblance to those produced by sulphuric acid. They e on *immediately*, and the swallowing of the acid is accompanied by in- se burning pain in the throat and gullet extending downwards to the nach: there are gaseous eructations, from the chemical action of the son, swelling of the abdomen, violent vomiting of liquid or solid matters, ed with altered blood of a dark brown colour, and shreds of yellowish- ured mucus, having a strong acid reaction. The abdomen is generally uisitely tender: but in one well-marked case of poisoning by the acid, pain was chiefly confined to the throat: probably the poison had not hed the stomach. The mucous membrane of the mouth is commonly soft white, after a time becoming yellow, or even brown; the teeth are also te, and the enamel is partially destroyed by the chemical action of the . There is great difficulty of speaking and swallowing, the mouth being d with viscid mucus: the power of swallowing is, indeed, sometimes entirely On opening the mouth, the tongue may be found swollen, and of a on colour; the tonsils are also swollen and enlarged. The difficulty of thing is occasionally such as to render tracheotomy necessary, especially oung persons. (See case by Mr. Arnott, 'Med. Gaz.' vol. 12, p. 220.) As symptoms progress, the pulse becomes small, frequent, and irregular—the ace of the body extremely cold, and there are frequent rigors (shivering). administration of remedies, even the swallowing of the smallest quantity iquid, increases the severity of the pain, occasions vomiting, and gives to a feeling of laceration or corrosion. (Tartra, 144.) There is obstinate tipation. Death takes place in from eighteen to twenty-four hours, and metimes preceded by a kind of stupor, from which the patient is easily ed. The intellectual faculties commonly remain clear until the last. In nstance the patient was insensible, but she ultimately recovered. Death be occasioned by the action of this acid on the larynx, as in the case of uric acid. Should the patient survive the first effects of the poison, the ous membrane of the throat and gullet may be discharged, either in ular masses, or in the form of a complete cylinder. There is great bility of the stomach, with pain on taking food, frequent vomiting and nate destruction of the powers of digestion: the patient becomes slowly iated, and dies, sometimes after many months, from starvation or ex- tion. A man swallowed nitric acid in beer: he recovered from the first toms, but died six months afterwards, evidently from the injury caused e poison to the mucous lining of the stomach. He suffered from pain rom such irritability in this organ, that neither solids nor fluids could tained. ('Lancet,' Nov. 24, 1860, p. 510.)

e *vapour* of this acid is destructive to life. In March 1854, *Mr. ood*, a chemist of Sheffield, lost his life under the following circum- es:—He was pouring a mixture of nitric and sulphuric acids from a y containing about sixty pounds, when by some accident the vessel was broken. For a few minutes he inhaled the fumes of the mixed acids, but it does not appear that any of the liquid fell over him. Three hours after the accident, he was sitting up and appeared to be in moderately good health. He was then seen by a medical man, and complained merely of some cuts about his hands. He coughed violently. In three hours more there was difficulty of breathing, with increase of the cough. There was a sense of tightness at the lower part of the throat, and the pulse was hard. At times he said he could scarcely breathe. He died eleven hours after the accident. On inspection, there was congestion of the windpipe and bronchial tubes, with effusion of blood in the latter. The heart was flaccid, and contained but little blood; and the lining membrane of the heart and aorta was inflamed. The blood gave a slightly acid reaction with test paper. The windpipe was not examined. It is very probable the seat of mischief was in this organ, and that the deceased died from inflammatory effusion and enlargement of the parts about the opening of the windpipe. ('Lancet,' April 15, 1854, p. 430.) A similar accident occurred to *Mr. Stewart* and one of the janitors of an educational institution in Edinburgh in March 1863. A jar of nitric acid, which he was carrying, fell on the floor and was broken. He and the janitor, instead of withdrawing from the spot, wiped the floor, and attempted to save some of the acid. They thus inhaled the fumes which were immediately diffused. Mr. Stewart returned home unconscious of the mischief which had been done. After an hour or two, difficulty of breathing came on, and in spite of every medical effort to save his life, he died in ten hours after the accident. The janitor suffered from similar symptoms, and died the day following. ('Chemical News,' March 14, 1863, p. 132.) It is probable that in these cases, there was great bronchial effusion leading to the entire obstruction of respiration. The fumes of nitrous acid vapour, which is generally associated with nitric acid, are of a very deadly kind. In the manufacture of gun-cotton acid vapours are evolved, which, if respired, although they may produce no immediate ill effects, are liable to cause pneumonia and death. On one occasion, in preparing gun-cotton, I accidently inhaled the vapour, and suffered from severe constriction of the throat, tightness in the chest, and cough for more than a week.

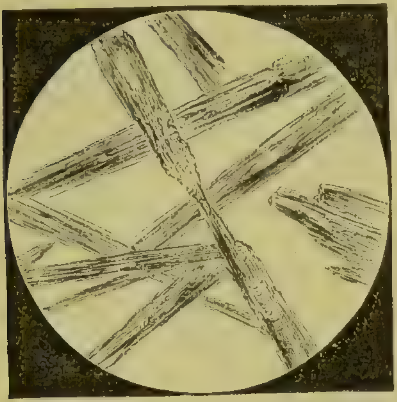
Appearances after Death.—Supposing death to have taken place rapidly from the liquid acid, the following appearances may be met with. The skin of the mouth and lips will present various shades of colour, from an orange-yellow to a brown; it appears like the skin after a blister or burn, and is easily detached from the subjacent parts. Yellow spots produced by the spilling of the acid may be found about the hands and neck. A yellow frothy liquid escapes from the nose and mouth; and the abdomen is often much distended. The membrane lining the mouth is sometimes white, at others of a citron colour; the teeth are white, but present a yellowish colour about the coronæ. The pharynx and larynx are much inflamed; the latter is sometimes œdematous. The lining membrane of the gullet is softened, and of a yellow or brown colour, easily detached, often in long folds. The trachea is more vascular than usual, and the lungs are congested. The most strongly marked changes are, however, seen in the stomach. When not perforated, this organ may be found distended with gas, its mucous membrane partially inflamed, and covered by patches of a yellow, brown, or green colour, or it may be even black. This green colour is due to the action of the acid on the colouring matter of the bile; but it must be remembered that a morbid state of the bile itself may give a similar appearance to the mucous membrane in many cases of death from natural disease. There is occasionally inflammation of the peritoneum, and the stomach is glued to the surrounding organs. Its coats may be so much softened, as to break down under the slightest essure. In the duodenum similar changes are found; but in some cases e small intestines have presented no other appearance than that of slight dness. It might be supposed that the stomach would be in general perforated this corrosive liquid; but perforation has not been often observed. Tartra et with only two instances, and in one of these the person survived twenty, d in the other thirty hours. In giving this poison to rabbits, I have not und the stomach perforated, although the acid had evidently reached that gan, as its coats were stained of a deep yellow colour. In these experiments e non-perforation appeared to be due to the protective influence of the food h which the stomach was distended. In the few cases that are reported in glish journals, it would appear that the stomach has not been perforated: e poison had been swallowed soon after a meal, and its coats had thus escaped e corrosive action of the acid. In the case above referred to (p. 169), hich proved fatal after the long period of six months, there was, at the estinal end of the stomach, a distinct cicatrix with puckering and hardening the surrounding mucous membrane, causing a slight contraction of the loric orifice. The only other appearance consisted in some dark longitudinal es on the posterior surface of the lining membrane of the gullet. This had obably been caused by the acid. ('Lancet,' Nov. 24, 1860, p. 510.)

Quantity required to destroy Life.—The *smallest* quantity of this acid which ind reported to have destroyed life, is about *two drachms.* It was in the e of a boy, aged thirteen: he died in about thirty-six hours. But less than s quantity, even one drachm, would doubtless suffice to kill a child, and, der certain circumstances, an adult; for the fatal result depends on the extent the mischief produced by this corrosive poison in the windpipe, gullet, and mach. What is the largest dose of concentrated acid, from the effects of ich a person has recovered, it is difficult to say; since in most of the cases recovery mentioned by authors, the quantity of the poison taken, was known.

Period at which Death takes place.—Sobernheim relates a case of poisoning nitric acid, which proved fatal in *one hour and three quarters.* (Op. cit. .) This I believe to be the most rapidly fatal instance on record, where acid acted as a poison. The usual well-marked effects were found in the let, stomach, and small intestines. In infants, however, life may be destroyed this poison in a few minutes, should it happen to affect the larynx. The gest case is, perhaps, that recorded by Tartra, where a woman perished n exhaustion, produced by the secondary effects of the poison, *eight months* r having swallowed it.

hemical Analysis.—In the simple state.—This acid may be met with either centrated or diluted. The *concentrated acid* varies in colour from a deep ge red to a light straw yellow. It may be recognized, 1. By evolving fumes when exposed to the air or when heated. 2. By its staining organic ter yellow or brown, the colour being heightened and turned to a reddish by contact with caustic alkalies. 3. When mixed with a few copper cut- s, it is rapidly decomposed, a deep red acid vapour is given off, and a nish coloured solution of nitrate of copper is formed. Tin or mercury may ubstituted for copper in this experiment. 4. The addition of gold-leaf and w drops of hydrochloric acid. On warming the mixture, if nitric acid is ent the gold is dissolved. Common aqua fortis (nitric acid) sometimes ains as impurity, a sufficiency of hydrochloric acid to dissolve gold-leaf eat. *In the diluted state.* This acid is not precipitated like the sulphuric, ny common reagent, since all its alkaline combinations are soluble in water. he liquid has a highly acid reaction, and on boiling it with some copper ings, red fumes of nitrous acid vapour are given off, unless the proportion ater is very great. At the same time, the liquid acquires a blue colour.

2. A streak made on white paper with the diluted acid does not carbonize it when heated; but a scarcely visible yellow stain is left. 3. The liquid is neither precipitated by nitrate of baryta nor by nitrate of silver. These two last experiments give merely negative results: they serve to show that the sulphuric and hydrochloric acids are absent.


Crystals of Nitrate of Potash, magnified 30 diameters.

In order to detect nitric acid, the liquid should be carefully neutralized by potash, and then evaporated slowly to obtain crystals. If the liquid contain nitric acid, these crystals will possess the following characters: 1. They appear in the form of lengthened fluted prisms, which neither effloresce nor deliquesce on exposure. One drop of the solution, evaporated spontaneously on glass, will suffice to yield distinct and well-formed prismatic crystals. This character distinguishes the *nitrate* of potash from a large number of salts. 2. When moistened with strong sulphuric acid, the powdered crystals slowly evolve a colourless acid vapour. By this test, the nitrate is known from every other deflagrating salt. 3. A portion of the powdered crystals should be placed in a small tube and mixed with their bulk of fine *copper* filings. The mass is then to be moistened with water, and a few drops of strong *sulphuric acid* added. Either with or without the application of a gentle heat, a decomposition immediately ensues, by which red fumes of *nitrous acid* are evolved, recognizable by their colour, odour, and acid reaction. In operating on a small quantity of nitrate free from chloride, the crystals may be placed in a watch-glass and mixed with one or two drops of concentrated sulphuric acid and a few copper filings. Invert over this another watch-glass containing a small slip of blue litmus-paper wetted, and a slip of starch-paper moistened with a solution of iodide of potassium. After a longer or shorter interval the litmus will be reddened, and the starch-paper will assume a blue-black colour. If the nitrate should be mixed with much chloride, then the power of dissolving leaf-gold on boiling the dry salt with strong hydrochloric acid, furnishes the best means of detection. 4. We add to the crystals a small portion of gold-leaf and hydrochloric acid; then boil for a few minutes. The gold will either wholly or entirely disappear if nitric acid or a nitrate is present. Its partial solution will be indicated by a dark purple colour on the addition of chloride of tin to the liquid after boiling.

In liquids containing organic matter. Nitric acid may be administered in such liquids as tea, vinegar, or porter. In this case, besides the acid reaction, there will be a peculiar smell produced by the strong acid, when mixed with substances of an organic nature. The application of the usual tests may be here counteracted: thus, unless the quantity of nitric acid in the liquid is considerable, the orange-red fumes of nitrous acid are not evolved on boiling it with copper cuttings. If the liquid is viscid, this viscidity must be destroyed by dilution with water: and in all cases, if any solid or insoluble substances are present, as in the *matters vomited* or *contents of the stomach*, it must be filtered, in order to separate the insoluble portions. This operation is commonly very slow, and in place of filtration, the process of dialysis may be resorted to for separating the acid from the mucous and other contents of the stomach. If we succeed in procuring a clear acid liquor, the colour may be disregarded. After warming the acid, we should carefully neutralize it with a weak solution of carbonate of potash: it may then be concentrated by evaporation. Paper dipped into this liquid and dried, burns with deflagration, d a few drops on a glass slide will yield crystals possessing those properties ich have been described as characteristic of the compound of potash with ric acid. The crystals so obtained may be coloured and impure: but this es not interfere with the action of the most important test for nitric acid, mely the mixture of copper filings and sulphuric acid. The crystals may, wever, if necessary, be purified by washing them with ether or alcohol. ese liquids do not dissolve the nitrate of potash, but will often serve to nove from it the organic matters by which it is coloured. When either the ric acid, or the nitrate into which it has been converted, is mixed with nmon salt, the copper test cannot be employed. The gold test will in such ase furnish the best evidence. Hydrochloric acid with a small portion of d-leaf may be added to the dried residue, and the mixture boiled. If ric acid or a nitrate is present, even in minute proportion, some portion of gold will be dissolved, a fact demonstrable by the addition of chloride of tin. Nitric acid may be detected in *stains on clothing*, if recent, by simply boil- the stained cloth in water, with or without the addition of a small quan- of carbonate of potash. The carbonate must be used when an *acid* liquid not obtained by boiling the stained cloth in distilled water.

HYDROCHLORIC ACID. MURIATIC ACID.

This acid, which is also called Muriatic acid, and is popularly known under name of Spirit of salt, is but seldom taken as a poison. In the few cases ich have been hitherto observed, the *symptoms* and *appearances* have been ilar to those caused by nitric acid. The following case of poisoning by acid occurred in King's College Hospital, in May 1859. A woman, æt. y-three, swallowed *half an ounce* of concentrated hydrochloric acid. She received into the hospital in three quarters of an hour. The prominent nptoms were burning pain in the throat and stomach, feeble pulse, cold clammy skin, retching and vomiting of a brown matter streaked with od and containing shreds of membrane. There was great exhaustion. The oat became swollen, the patient lost the power of swallowing, and died in nteen hours. She retained her senses until the last. The *appearances* in body were as follows: the mucous membrane of the mouth and throat white, softened, and destroyed in many places by the corrosive action of acid. The membrane of the gullet was red and inflamed. The back of the stomach near the pylorus was black, stripped of its mucous mem- ne (which was generally softened), and marked with black lines. It was perforated. ('Lancet,' July 16, 1859, p. 59.) In this case the smallest ntity of hydrochloric acid was taken which has as yet been known to prove l. I have elsewhere related a case of poisoning by this acid ('Guy's Hosp. .' Oct. 1850, p. 211); and for other cases in which an ounce was taken and persons recovered, see 'Lancet,' July 27, 1850, p. 113, and the 'Medical ette,' Dec. 28, 1849. For a more detailed account of poisoning by this , see 'ON POISONS,' second edition, p. 289.

hemical Analysis.—In a *concentrated* state, hydrochloric acid evolves ous fumes. The pure acid is nearly colourless: the commercial acid is lemon yellow colour, and frequently contains iron, arsenic, and other urities. When boiled with a small quantity of peroxide of manganese, rine is evolved. It does not dissolve gold-leaf until a few drops of nitric have been added to it, and the mixture is heated. In the *diluted* state, properties are lost. It may then be recognized by the dense white ipitate which it gives when a solution of nitrate of silver is added to it. precipitate is insoluble in nitric acid: it acquires a purple and black ur if exposed to light, and when heated, it melts without decomposition, ing a yellowish-coloured substance on cooling.

Hydrochloric acid, as well as alkaline chlorides, are natural constituents of the fluids of the alimentary canal. The presence of local chemical changes in the throat and stomach, would show whether the acid had been taken as a poison. If the acid is found only in small quantity, no inference of poisoning can be drawn unless there are distinct marks of its chemical action upon the throat and stomach. It darkens the blood like sulphuric acid, although it has not the same degree of carbonizing action on organic matter.

CHAPTER 14.

POISONING BY VEGETABLE ACIDS. OXALIC ACID—SYMPTOMS AND EFFECTS—APPEARANCES AFTER DEATH—CHEMICAL ANALYSIS—ACID OXALATE OF POTASH OR SALT OF SORREL. TARTARIC ACID. ACETIC ACID. VINEGAR.

Oxalic Acid.

Symptoms.—If this poison is taken in a large dose, i. e. from half an ounce to an ounce of the crystals dissolved in water, a hot burning acid taste is experienced during the act of swallowing it. This is accompanied by a similar sensation extending through the gullet to the stomach. There is sometimes a sense of constriction or suffocation: the countenance is livid and the surface of the skin soon becomes cold and clammy. Vomiting occurs either immediately or within a few minutes. Should the poison be diluted, there is merely a sensation of strong acidity, and vomiting may not occur until after a quarter of an hour or twenty minutes. In some cases there has been little or no vomiting: while in others, this symptom has been incessant until death. In a case which occurred to Dr. Page, in which an ounce of the acid was swallowed, the vomiting with pain in the stomach continued until the fifth day, when the man died suddenly. ('Lancet,' Nov. 24, 1860, p. 509.) In a case in which the poison was much diluted, vomiting did not occur for seven hours. ('Christison,' 221.) The vomited matters are highly acid, and have a greenish-brown or almost black colour; they consist chiefly of mucus and altered blood. In one instance, reported by Dr. Geoghegan, they were colourless. ('Medical Gazette,' vol. 37, p. 792.) In another case, reported by Mr. Deane in the 'Provincial Journal,' fluid blood of a bright arterial colour was vomited after some hours. (June 25th, 1851, p. 344.) There is great pain and tenderness in the abdomen, with a burning sensation in the stomach. There are cold clammy perspirations and convulsions. In a case which occurred at Guy's Hospital, in May 1842, in which about two ounces of the poison had been swallowed, there was no pain. Violent vomiting and collapse were the chief symptoms. There is in general an entire prostration of strength, so that if the person is in the erect position, he falls; there is likewise unconsciousness of surrounding objects, and a kind of stupor, from which, however, the patient may be without difficulty roused. Owing to the severity of the pain, the legs are sometimes drawn up towards the abdomen. The pulse is small, irregular, and scarcely perceptible; there is a sensation of numbness in the extremities, and the respiration, shortly before death, is spasmodic. The inspirations are deep, and a long interval elapses between them. Such are the symptoms commonly observed in a rapidly fatal case.

Should the patient survive the first effects of the poison, the following symptoms may appear: there is soreness of the mouth, constriction and burning pain in the throat with pain in swallowing, tenderness in the abdomen, and irritability of the stomach, so that there is frequent vomiting, accompanied by purging. The tongue is swollen, and there is great thirst. The patient may slowly recover from these symptoms. In a case related by Mr. Edwards the Westminster Medical Society, the patient, a female, lost her voice for ht days. Another case has been reported by Mr. T. W. Bradley, from ich it may be inferred that a loss of voice may result from a direct effect of lic acid on the nervous system. A man swallowed a quarter of an ounce he acid, and suffered from the usual symptoms in a severe form. In about e hours his voice, although naturally deep, had become low and feeble. is weakness of voice remained for more that a month, and its natural ngth had not returned even after the lapse of nine weeks. During the t month there was numbness, with tingling of the legs. ('Med. Times,' t. 14, 1850, p. 292.) The occurrence of this sensation of numbness, and persistence for so long a period after recovery from the symptoms of irri- on, clearly point to a remote effect on the nervous system. Spasmodic tchings of the muscles of the face and extremities have also been observed ome instances. (See 'Lancet,' March 22, 1851, p. 329.)

ppearances after Death.—The mucous membrane of the tongue, mouth, oat, and gullet, is commonly white, as if bleached, but it is sometimes ted with a portion of the brown mucous matter discharged from the stomach. s latter organ contains a dark brown mucous liquid, often acid, and having ost a gelatinous consistency. On removing the contents, the mucous mbrane will be seen pale and softened, without always presenting marks of ammation or abrasion, if death has taken place rapidly. This membrane is te, soft, and brittle, easily raised by the scalpel, and presents the appear- e which we might suppose it would assume after having been for some time ed in water. The small vessels are seen ramifying over the surface, filled 1 dark-coloured blood, apparently solidified within them. The lining nbrane of the gullet presents the same characters. It is pale, and appears f it had been boiled in water, or digested in alcohol; it has been found ngly raised in longitudinal folds, interrupted by patches where the mem- ne has become abraded. In a case which was fatal in eight hours, the ue was covered with white specks; the gullet was not inflamed, but the nach was extensively destroyed, and had a gangrenous appearance. Portions he mucous membrane were detached, exposing the muscular coat. With ect to the intestines, the upper portion may be found inflamed; but, unless case is protracted, the appearances in the bowels are not strongly marked. well-marked instance of poisoning by this acid, however, which is re- ed by Dr. Hildebrand, the mucous or lining membrane of the stomach duodenum was much reddened, although the patient, a girl of eighteen, in three quarters of an hour after taking one ounce of the acid, by mis- for Epsom salts. (Casper's 'Vierteljshrschrift,' 1853, 3 B. 2 H. page) In a case of poisoning in which two ounces of the acid had been taken, death was rapid, the coats of the stomach presented almost the blackened arance produced by sulphuric acid, owing to the colour of the altered d spread over them. In protracted cases, the gullet, stomach, and intes- have been found more or less congested or inflamed. In a case in which nce was swallowed, and death occurred on the fifth day, the stomach was ly congested and contained a bloody fluid, but the mucous membrane entire. ('Lancet,' Nov. 24, 1860, p. 509.)

am indebted to Mr. Welch for the following case:—A woman aged y-eight, swallowed *three drachms* of the crystallized acid. She was quite dead in *one hour* afterwards. On examining the body, both lungs observed to be extensively congested, and the heart and large vessels full of dark-coloured blood. The stomach contained about three quarters pint of a dark-brown fluid, and its lining membrane was generally red- . The other organs, except the brain, were healthy, and this presented rances indicative of long-standing disease. This case is remarkable from the smallness of the dose, the rapidity of death, and the early production of a well-marked redness of the mucous membrane of the stomach. The diseased state of the body may have tended to accelerate death from the poison. In one instance the larynx was found filled with frothy mucus, and the left side of the heart and the lungs were gorged with dark-coloured fluid blood. In another, the appearances of sanguineous apoplexy were found in the brain. A person fell dead after retching violently. Apoplexy was supposed to be the cause of death. On an inspection of the body, it was found that a large clot of blood was effused on the brain, and this appeared to account for death satisfactorily. But when the stomach was examined, oxalic acid was detected in it. This poison had been taken and had produced its usual effects. The deceased had taken it with suicidal intention, and the violent vomiting which it caused had led to death by apoplexy from effusion of blood. ('Lancet,' 1, 1863, p. 47.) Without a proper chemical investigation, it is obvious that the real cause of death would have been in this instance overlooked. In a few cases there have been scarcely any morbid appearances produced by this poison.

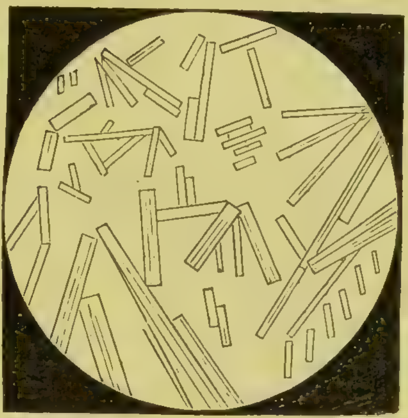
It is worthy of remark that the glairy contents of the stomach do not always indicate strong acidity until after they have been boiled in water. Oxalic acid does not appear to have a strongly corrosive action on the stomach, like that possessed by the mineral acids. It is therefore rare to hear of the coats of the organ being perforated by it. In many experiments on animals, and in some few observations on the human subject, I have found nothing to bear out the view that perforation is a common effect of the action of this poison. The acid undoubtedly renders the mucous coat soft and brittle, and perforation of the coats may occur either during life or after death as a result of its chemical action. Dr. Wood has recorded the case of a female, æt. twenty-seven, found dead, whose death had been obviously caused by oxalic acid, but the quantity taken, and the duration of the case, were unknown. The stomach presented, at its upper and fore part near the cardiac opening, an irregular aperture of a size to admit the point of the finger. From this, a dark gelatinous-looking matter, resembling coffee-grounds, was escaping in abundance. The perforation was enlarged during the removal, and presented the appearance of two large apertures separated by a narrow band. The stomach contained a bloody fluid, in which oxalic acid was detected, and the mucous membrane had an eroded appearance. The small intestines (jejunum and ileum) were similarly affected.

Quantity required to destroy Life.—The smallest quantity of this poison which has been known to destroy life is *one drachm* (sixty grains). The boy, æt. sixteen, was a patient of Dr. Barker's, of Bedford. He took the poison in a solid form, and was found in about an hour insensible, pulseless, and his jaws spasmodically closed. He had vomited some bloody matter: his tongue and lips were unusually pale, but there was no excoriation. He died in eight hours. ('Lancet,' Dec. 1, 1855.) In Mr. Welch's case (suprà) *three drachms* destroyed life in an hour. Two cases occurred at Guy's Hospital, in each of which half an ounce of oxalic acid had been swallowed. Active treatment was adopted, and both patients recovered. When the dose is upwards of half an ounce, death is commonly the result; but one of my pupils informed me of a case in which a man recovered after having taken an ounce of crystallised oxalic acid. Dr. Brush, of Dublin, has communicated to the 'Lancet' a case in which recovery took place after a similar dose of the poison had been taken. (See also a case by Mr. Alison in the same journal, Nov. 2, 1850, p. 502.) The acid was in this instance taken by mistake for Epsom salts.

Period at which Death takes place.—Similar quantities of this poison do not destroy life within the same period of time. In two cases, in which about

o ounces of the acid were respectively taken, one man died in twenty
nutes—the other in three-quarters of an hour. Dr. Christison mentions
instance in which an ounce killed a girl in thirty minutes; and another in
ich the same quantity destroyed life in *ten minutes*; but in a third case
ith did not occur until the fifth day. The late Dr. Ogilvy, of Coventry,
reported a case of poisoning by oxalic acid, in which it is probable
t death took place within *three minutes* after the poison had been swallowed.
e sister of the deceased had been absent from the room about that period,
l on her return found her dying. The *quantity* of poison taken could not
determined. When the dose of oxalic acid is half an ounce and upwards,
th commonly takes place in an hour. There are, it must be admitted,
nerous exceptions to this rapidity of action. Dr. Christison reports two
es, which did not prove fatal for thirteen hours; and in an instance that
urred to Mr. Fraser, in which half an ounce was taken, the individual died
n the secondary effects in a state of perfect exhaustion, twenty-three days
r taking the poison.

hemical Analysis. In the simple state.—This acid may be met with,
er as a solid, or in solution in water. *Solid oxalic acid:* It crystallizes in
slender prisms, which, when perfect, are
-sided. In this respect it differs from other
mon acids, mineral and vegetable. The
tals are unchangeable in air; they are
ble in water and alcohol, forming strongly
solutions. When heated on platinum foil
melt, and are entirely dissipated without
bustion and without being carbonized.
ted in a close tube, they melt, and the
ur is condensed as a white crystalline sub-
te in a cold part of the tube. There should
o residue whatever if the acid is pure: but
commercial acid generally leaves a slight
lue of fixed impurity. By this effect of
, oxalic acid is easily distinguished from those crystalline salts for which
s been sometimes fatally mistaken, namely, the sulphates of magnesia
zinc. These leave white residues in the form of anhydrous salts.



Crystals of Oxalic Acid, magnified 30 diameters.

ests.—1. *Nitrate of silver.*—When added to a solution of oxalic acid, it
uces an abundant white precipitate of oxalate of silver. A solution con-
ng so small a quantity of oxalic acid as not to redden litmus-paper, is
ted by this test; but when the quantity of poison is small, it would be
ys advisable to concentrate the liquid by evaporation before applying it.
oxalate of silver is identified by the following properties: 1. It is com-
ly dissolved by cold nitric acid. If collected on a filter, thoroughly dried,
heated on thin platinum foil, it is entirely dissipated in a white vapour
a slight detonation. When the oxalate is in small quantity, this detona-
may be observed in detached particles on burning the filter previously
dried. 2. *Sulphate of lime.* A solution of oxalic acid is precipitated
by lime water and all the salts of lime. Lime water is itself objection-
as a test, because it is precipitated white by several other acids. The
f lime, which, as a test, is open to the least objection, is the *sulphate.*
is is not a very soluble salt, its solution must be added in rather large
ity to the suspected acid poisonous liquid. A white precipitate of oxalate
ne is slowly formed. This precipitate should possess the following pro-
s:—1. It ought to be immediately dissolved by nitric or hydrochloric
2. It ought not to be dissolved by the tartaric, acetic, or any vegetable acid.
liquids containing Organic Matter.—The process is the same, whether it

is applied to liquids in which the poison is administered, or to the *matters vomited*, or, lastly, to the *contents of the stomach*. This poison readily combines with albumen and gelatine, and it is not liable to be decomposed or precipitated by these or any other organic substances: it is, therefore, commonly found in solution in the liquid portion, which will then be more or less acid. Sulphate of copper produces a greenish white precipitate in the liquid, if the oxalic acid is in large quantity. Should the liquid be very acid, we must filter it to separate any insoluble matters; should it not be very acid, the whole may be boiled, if necessary, with distilled water, before filtration is performed. On no account are the tests for oxalic acid to be employed in liquids containing organic matter, since nitrate of silver is easily precipitated by such matters, although none of the poison is present. Should the acid liquid be highly coloured, it may be first boiled for some time with well-washed animal charcoal. After this it may be filtered and concentrated by evaporation. To the filtered liquid, acidulated with acetic acid, *acetate of lead* should be added until there is no further precipitation; and the white precipitate formed, collected and washed. If any oxalic acid was present in the liquid, it would exist in this precipitate under the form of oxalate of lead. The following plan may be adopted for separating oxalic acid from the oxalate of lead:—Diffuse the precipitate in water, and pass into the liquid, for about half an hour, a current of sulphuretted hydrogen gas, taking care that the gas comes in contact with every portion of the precipitate. Black sulphide of lead will be precipitated: and with it commonly the greater part of the organic matter, which may have been mixed with the oxalate of lead. Filter, to separate the sulphide of lead; the filtered liquid may be clear and highly acid. Concentrate by evaporation; the sulphuretted hydrogen dissolved in the liquid is thereby expelled, and oxalic acid may be ultimately obtained crystallized by slow evaporation in a watch-glass or on a glass-slide, for microscopical observation. If there was no oxalic acid in the precipitate, no crystals will be procured by evaporation. If crystals are obtained, they must be dissolved in water, and tested in the manner above directed. Should the organic liquid contain sulphuric acid or sulphates, these should be separated before precipitation by lead is resorted to.

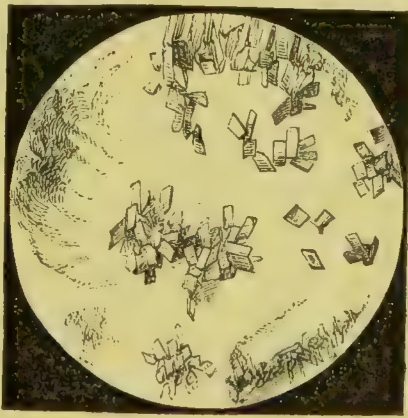
As oxalic acid is very soluble in alcohol, this liquid may be occasionally employed for separating it from the contents of the stomach and from many organic compounds. Crystals may be obtained from the alcoholic solution, and these may be purified and tested by the methods already described. In some cases the process of dialysis may be resorted to for separating this acid from starch, albumen, gelatin, mucus, and other organic compounds which give viscidity to water, and which are present in the stomach at the time of death. In cases of poisoning, the residuary quantity found in the stomach is generally small. In one instance, in which about an ounce and a half had been taken, and the person died in two hours, I found only thirteen grains. This is owing to the ejection of the greater portion by vomiting. In *Reg.* v. *Cochrane* (Liverpool Summer Assizes, 1857), in which it was charged that two children, aged six and four years respectively, had been wilfully poisoned by their mother, it was stated by the medical witness, Dr. Edwards, that he found forty-two grains of oxalic acid in the stomach of the elder, and twenty grains in that of the younger child. It was not clearly established when or how this large quantity of poison could have been wilfully administered to the children, and the prisoner was acquitted.

Acid Oxalate of Potash, or Salt of Sorrel.

Symptoms and Effects.—The poisonous effects of this salt entirely depend on the oxalic acid which it contains. It is much used for the purpose of bleaching straw and removing ink-stains, being sold under the name of sential salt of lemons. Its poisonous properties are not generally known, or doubt it would be frequently substituted for oxalic acid. Out of three es of poisoning by this substance, two proved fatal, while in the other the ient recovered. In the case of recovery, a young lady, aged twenty, allowed an ounce of the salt dissolved in warm water. She was not seen any one for an hour and a half: she was then found on the floor, faint and hausted, having previously vomited considerably. There was great depres- n, the skin cold and clammy, the pulse feeble, and there was a scalding sation in the throat and stomach. There was also continued shivering. oper medical treatment was adopted, and she recovered in two days, still fering from debility and great irritation of the stomach. During the state depression, it was remarked that the conjunctivæ (membranes of the eyes) re much injected, and the pupils dilated. There was also great dimness of ion. ('Med. Gaz.' vol. 27, p. 480.) In another case, two hundred and nty-five grains were taken (about half an ounce). Bicarbonate of soda given as an antidote, and the patient completely recovered. ('Med. nes and Gazette,' Feb. 12, 1859.) The recovery must have taken place in e of the antidote, for the oxalate of soda is just as poisonous as the late of potash. For a third case of recovery, see the same journal, Oct. 1859, p. 378.

his salt destroys life almost as rapidly as oxalic acid itself: and in the ptoms which it produces, it closely resembles that poison. In one case, an ounce killed an adult in so short a time as *eight minutes*; but probably fatal effects were in this instance accelerated by the debilitated state of person who took it. In another case, reported by M. Chevallier, death place in ten minutes. ('Ann. d'Hyg.' 1850, vol. 1, p. 162.)

hemical Analysis.—It is not very soluble in cold water, but its solution may eadily mistaken for that of oxalic acid. 1st, it an acid reaction; and 2nd, it is precipitated itrate of silver and sulphate of lime, like ic acid: but with the latter test the preci- ion is much more copious. It is distinguished oxalic acid. 1. By its crystals, which when ly produced on a glass slide assume the e of rhombic prisms, sometimes grouped in a ose form; and 2. By heating a portion on num foil. While oxalic acid is volatile, the xalate leaves an ash, which, when suffi- ly calcined, is white and alkaline; it may be ed to contain carbonate of potash by its dis- ng with effervescence in diluted nitric acid, orming nitrate of potash.



Crystals of Acid Oxalate of Potash, magnified 30 diameters.

some instances this poisonous salt has been supplied by mistake for of tartar, and has caused death. Cream of tartar, or acid tartrate of h, leaves a black alkaline residue when calcined. Its solution is less acid that of the salt of sorrel. It is not precipitated by the nitrate of silver lphate of lime. The different action of the two salts on writing ink s a simple means of identification. The binoxalate of potash imme- y discharges the colour of ink when warmed, while the acid tartrate does ossess this property.

TARTARIC ACID.

nptoms and Appearances.—Tartaric acid is not commonly regarded poison; but one case has occurred, in which there was no doubt t acted as an irritant, and destroyed life. The case referred to, was the subject of a trial for manslaughter at the Central Criminal Court (*Reg.* v. *Watkins*), in January, 1845. The accused gave to the deceased, a man aged twenty-four, *one ounce* of tartaric acid instead of aperient salts. The deceased swallowed the whole dissolved in half a pint of warm water; he immediately exclaimed that he was poisoned; he complained of having a burning sensation in his throat and stomach, as though he had drunk oil of vitriol, and that he could compare it to nothing but being all on fire. Soda and magnesia were administered with diluent drinks. Vomiting set in, and continued until death, which took place nine days afterwards. On inspection, nearly the whole of the alimentary canal was found highly inflamed. The accused admitted that he had made a mistake, and tartaric acid was found in the dregs of the cup. The jury acquitted the prisoner. Another case of poisoning by this acid, with a report of the results of analysis, has been published by M. Devergie. ('Ann. d'Hyg.' 1851, vol. 2, p. 432.) This case gave rise to a controversy between the late M. Orfila and M. Devergie, the points in dispute relating chiefly to the processes for the detection of the acid in the stomach and tissues. (See 'Ann. d'Hyg.' 1852, vol. 1, pp. 199, 382, and vol. 2, p. 230.)

Acetic Acid.

This acid has been generally excluded from the class of poisons. Common *Vinegar*, which contains only five per cent. of acetic acid, has been often taken in large doses without injurious consequences. From the experiments performed by Orfila on dogs, and from one case which he reports as having occurred in the human subject, acetic acid, when concentrated, appears to exert an irritant action on the body. ('Annales d'Hygiène,' 1831, vol. 2, p. 159: also 'Toxicologie,' vol. 2, p. 198.) This is not more than we might have expected, seeing that the concentrated acid is highly corrosive. In the case referred to, the deceased, a female aged nineteen, was found dying on the highway. She suffered from convulsions, complained of pain in the stomach, and died in a short time. On inspection, the stomach was found neither softened nor corroded, but its mucous membrane near the pylorus was almost black. The mucous glands were prominent, and the vessels were filled with dark coagulated blood.

Vinegar, which may be regarded as an organic mixture containing a small proportion of acetic acid, may be examined by distilling a portion, and testing the distilled liquid for the acid. Vinegar, as it exists in commerce, always contains a small quantity of sulphuric acid, and occasionally traces of arsenic, lead, and copper. In general it is easily recognized by its odour. Pelletan observed in the case of a child, that the abuse of vinegar led to a thinning of the mucous membrane of the stomach; and Landerer remarked that the milk of a wet-nurse who had been in the habit of taking large quantities of the Vinegar of Roses, became thin, very acid, and deficient in casein and oil. The infant which she was suckling gradually wasted and died, and the woman herself suffered severely. (Heller's 'Archiv.' 1847, 2 H. S. 185.)

CHAPTER 15.

POISONING BY THE ALKALIES.—POTASH, SODA, AND THEIR CARBONATES—SYMPTOMS—FATAL EFFECTS OF THE CARBONATE OF POTASH—APPEARANCES AFTER DEATH—AMMONIA AND ITS CARBONATE (SAL VOLATILE)—CHEMICAL ANALYSIS.

Potash and Soda.

Symptoms.—The symptoms produced by potash and soda, when taken in large doses, are so similar that one description will serve for both. Cases of alkaline poisoning are, however, rare, and have been, generally, the result of

ident. The most common form in which these poisons are met with, is in
state of pearlash (carbonate of potash) and soap-lees (carbonate of soda).
e patient experiences, during the act of swallowing, an acrid caustic taste,
ing to the alkaline liquid, if sufficiently concentrated, excoriating the
cous membrane. There is a sensation of burning heat in the throat, ex-
ding down the gullet to the stomach. Vomiting is not always observed;
when it does occur, the vomited matters are sometimes mixed with blood
a dark brown colour, and with detached portions of mucous membrane:
effect depending on the degree of causticity in the liquid swallowed.
surface is cold and clammy: there is purging, with severe pain in the
omen, resembling colic. The pulse is quick and feeble. In the course of
ort time, the lips, tongue, and throat become swollen, soft, and red.

ppearances after Death.—In recent cases there are marks of the local ac-
of the poison on the mucous membrane of the mouth, throat, and gullet.
s membrane has been found softened, detached, and inflamed in patches of
eep chocolate colour, sometimes almost black. A similar appearance has
n met with in the mucous membrane of the larynx and windpipe. The
nach has had its mucous surface eroded in patches, and there has been
ial inflammation. In one instance, as a result of the action of soda, I
d it puckered and blackened.

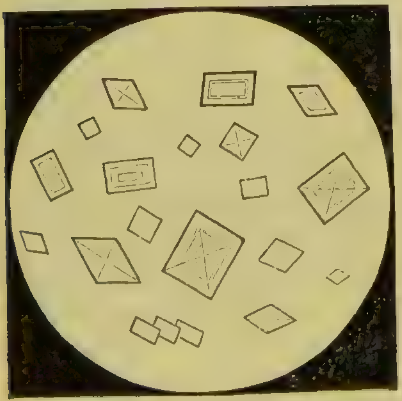
eriod of Death.—The most rapidly fatal case which I have found reported
at of a boy, who died in *three hours* after swallowing three ounces of a
ng solution of carbonate of potash. In a case which occurred in 1835, a
d, aged three years, took a small quantity of concentrated solution of pearl-
which had deliquesced, and died in twenty-four hours. Death was caused
is instance by the inflammation induced in the larynx, causing suffocation.
his respect, the caustic alkalies may destroy life rapidly, like the mineral
s. But death may be also a slow result of these poisons. Thus in an in-
ce which was communicated to me, a lady swallowed, by mistake, one
ce and a half of the common solution of potash of the shops, which con-
s about five per cent. of caustic alkali. She recovered from the first
ptoms of irritation, but died seven weeks afterwards, from pure exhaus-
, becoming greatly emaciated before her death. The alkali had probably de-
yed the lining membrane of the stomach, and had thus impaired digestion.

arbonates.—Dr. Barclay has reported a case of poisoning by potash,
h furnishes a good illustration of the after-effects and appearances caused
his poison. A woman, aged forty-four, was admitted into St. George's
pital, May 2, 1853, about six hours and a half after she had swallowed a
tity of American potash, probably a saturated solution of carbonate of
sh (American pearlash). She had vomited immediately after taking it.
mouth and throat were much corroded. There was burning pain in the
t and gullet, extending downwards to the stomach; but there was no
rness on pressure. Two days after her admission, there was a little
ting. The mucous membrane, as far as it could be seen, was destroyed;
was difficulty of swallowing, and occasionally pain after food had entered
stomach. In about a month, there was frequent vomiting, with pain on
ure, and constipation; when food or medicine was taken, there was much
in the stomach, and in a short time the food was ejected. As the case
ressed, nothing could be retained on the stomach, and shortly before death
atient was supported only by nutritive injections. She died from starva-
n the 8th July, about two months after taking the alkali. On inspection,
wer part of the gullet was found much contracted, the lining membrane
ely destroyed, and the muscular coat exposed. The external coats were
thickened. The gullet end of the stomach, where the ulceration ceased,
considerably contracted. At the intestinal end, the mucous lining pre-
d a large and dense cicatrix, obstructing all communication with the

small intestines, except by an orifice no larger than a probe. The intervening portion of the stomach was healthy, as were also the large and small intestines. ('Med. Times and Gazette,' Nov. 26, 1853, p. 554.) In July, 1863, a case of poisoning by potash was the subject of an inquest in London.

Orfila refers to two cases of poisoning by carbonate of potash, in each of which half an ounce of this substance was taken by mistake for aperient salts. The patients, two young men, recovered from the first effects, but ultimately died: the one three months, and the other four months, after the poison had been taken. The secondary fatal effects appear to have been due to constant purging, great irritability of the stomach leading to incessant vomiting, and loss of the functions of this organ from the destruction of the lining membrane, with stricture, either of the gullet or of the apertures of the stomach,—either of which causes might prove fatal at almost any period. A fatal case of stricture, produced by soap-lees after the lapse of two years and three months, is reported by Dr. Basham ('Lancet,' March 2, 1850). The constant use of the alkalies or of their carbonates appears to be productive of latent mischief: yet the quantity which may be sometimes taken in divided doses without destroying life is enormous. Dr. Tunstall, of Bath, relates the case of a man who, for eighteen years, had been in the habit of taking bicarbonate of soda to remove dyspepsia. It is stated that for sixteen years he took *two ounces* of the bicarbonate daily! The man died suddenly, and on examining the stomach it was found to be greatly distended and extensively diseased,—conditions which were referred by Dr. Tunstall to the action of the carbonate of soda. ('Med. Times,' Nov. 30, 1850, p. 564.) The *quantity* of any of these alkaline poisons required to destroy life is unknown. The fatal effects depend rather on the degree of concentration of the liquid, than on the absolute quantity of alkali present.

Chemical Analysis.—Solutions of Potash and Soda have a strongly alkaline reaction; they are distinguished from those of their respective carbonates by giving brown precipitates with a solution of nitrate of silver. The Carbonates, on the other hand, yield a whitish-yellow precipitate. Potash is known from Soda by the following characters:—1. Its solution, when not too much diluted with water, is precipitated of a canary-yellow colour by perchloride of platinum. 2. It is precipitated in granular white crystals, on adding the alkaline liquid gradually to a strong solution of tartaric acid, containing a small quantity of alcohol, and occasionally stirring the mixture. Soda is not precipitated by either of these tests, which will serve equally to distinguish the *salts of potash* from those of soda, if we except the acid oxalate and acid tartrate of potash: these, from being but little soluble in water, are not precipitated. 3. If we neutralize the two alkalies by diluted nitric acid, and crystallize the liquid on a slip of glass,—should the alkali be potash, the crystals will have the form of long slender fluted prisms (p. 172); if soda, of rhombic plates. 4. Potash and its salts are known by their giving a reddish violet colour, while soda and its salts give a bright yellow colour to the colourless flame of alcohol.


Crystals of Nitrate of Soda, magnified 30 diameters.

In liquids containing Organic Matter.—Such liquids are frothy; they possess an alkaline reaction, a peculiar alkaline odour, and are soapy to the feel. The organic liquid may be evaporated to dryness, then heated in a capsule to char the animal and vegetable matter, and the alkali will be recovered from it in a state of carbonate, by digesting the residuary ash in distilled water.

Ammonia. Spirit of Hartshorn.

The *vapour* of strong ammonia is poisonous. It may destroy life by pro- cing violent inflammation of the larynx, or of the lungs and air passages. is often injudiciously employed to rouse persons from a fit. A case is on ord of an epileptic having died under all the symptoms of croup, two days er the application of strong ammonia to the nostrils. This had been em- yed to rouse him from a fit. A singular case of recovery from the poi- ous effects of this vapour, by Dr. Sanchard, is reported in the 'Annales ygiène' (Janvier 1841).

Symptoms and Appearances.—The strong *solution* of ammonia produces nptoms similar to those described in speaking of potash. The only dif- ence observed is, that the sense of heat and burning pain in the throat, let, and stomach, is much greater. Cases of this form of poisoning are e. Dr. Sanchard relates an instance that occurred in France, in which a , only six years old, poisoned his younger sister by pouring several tea- onfuls of a strong solution of ammonia down her throat. In one case strong dose of the solution killed a man in *four minutes*, by causing focation (Christison, 167): and another case is referred to in the 'Jour- de Pharmacie' (Oct. 1846, p. 285), in which from one to two drachms solution of ammonia, unknowingly administered, caused death. There was lent vomiting, with bloody purging; and, on inspection, blood was found used in the intestines. There was also a remarkably fluid state of the blood he body. In another instance, a man walked into a druggist's shop, and ed for a small quantity of ammonia to take spots out of his clothes. The ggist poured about a teaspoonful and a half into a glass. The man sud- ly swallowed it, and fell instantly to the ground. He soon afterwards d, complaining of the most excruciating pain. ('Journal de Chimie Médi- ,' 1845, p. 531.) A similar case occurred at Halifax in April 1857: a man llowed a large dose of ammonia, and died in a quarter of an hour. In er cases, in spite of a large dose, death has taken place slowly. Dr. Potain with an instance in which a man swallowed upwards of three ounces of commercial solution of ammonia, and he did not die from the effects until eleventh day. ('Journal de Chimie Médicale,' 1862, pp. 311 and 474.)

erious injury to the organs of respiration is sometimes the result of the on of this poison, as in the following case, which was referred to me for mination by my colleague, Mr. Hilton, in May, 1857. A gentleman liable ttacks of fainting, died in three days, after swallowing a quantity of a id administered to him by his son. This liquid, which was at the time eved to be sal volatile, was, in fact, a strong solution of ammonia. The ased complained immediately of a sensation of choking and strangling in act of vomiting. Symptoms of difficulty of breathing set in, with other s of irritation in the throat and stomach. The mucous membrane of the th and throat was corroded and dissolved: and it was evident that the id had caused great local irritation. The difficulty of breathing was such o threaten suffocation, and at one time it was thought that an operation t be resorted to. The state of the patient, however, precluded its per- ance, and he died on the third day. On *inspection*, the viscera presented g marks of corrosion. The covering of the tongue was softened, and had ed off; the lining membrane of the air-passages was softened and covered layers of false membrane, the result of inflammation, and the larger bron- tubes were completely obstructed by casts or cylinders of this membrane. lining membrane of the gullet was softened, and at the lower part, near unction with the stomach, the tube was completely dissolved and destroyed. re was an aperture in the stomach in its anterior wall, about one inch and a half in diameter: the edges were soft, ragged, and blackened, presenting an appearance of solution. The contents of the stomach had escaped. On the inside, the vessels were injected with dark-coloured blood, and there were numerous small effusions of blood in various parts of the mucous membrane. The coats were thinned and softened at the seat of the aperture. The blackened and congested appearance somewhat resembled that which is seen in poisoning by sulphuric or oxalic acid. The mucous matter on the coats of the stomach was feebly *acid.* No poison of any kind was found in the layer of mucous or in the coats. There was not in any part the slightest trace of ammonia, the poison which had caused the mischief. The deceased had lived three days: remedies had been used, and every trace of ammonia had disappeared. The immediate cause of death was an obstruction of the air tubes, as a result of inflammation, caused by the local irritant action of the poison. It was quite obvious that a quantity of the liquid had entered the windpipe. The perforation of the stomach had probably taken place shortly before death, or there would have been marks of peritonitis. The injury to the stomach and gullet would have been sufficient to cause death, even supposing that the liquid had not penetrated to the lungs. Dr. Patterson met with a case in which a man, æt. 40, swallowed an ounce of spirit of hartshorn. He ejected the liquid almost immediately, and complained of an intense burning pain and feeling of suffocation. None of it, he thought, had reached the stomach. Dr. Patterson saw him in two hours; his countenance was then suffused and anxious, the lips were livid, breathing difficult, extremities cold, pulse 100, the inside of the mouth and throat was raw and fiery-looking. He complained of pain in the situation of the larynx and under the left ear. The larynx was opened to relieve the breathing, but the relief was only temporary. He vomited blood, and before death suffered from great difficulty of swallowing. He died in nineteen days after taking the poison, obviously from the local injury done to the parts about the larynx. ('Ed. Med. Jour.' 1857, vol. 2, p. 236.)

Mr. Tyerman communicated to me the particulars of a case which occurred in Nov. 1858, in which a lunatic, æt. 62, swallowed about two fluid ounces of compound camphor liniment. The patient immediately complained of great heat in the stomach; vomiting was induced by giving to him warm water. The uvula, throat, and gullet were so intensely inflamed that he lost all power of swallowing; and the efforts to swallow liquids produced violent retching. The symptoms gradually abated, and the man recovered in four days. In this case the quantity of ammonia swallowed was small, amounting to about two and a half drachms, diluted with about six times the quantity of rectified spirit. One of my pupils, Mr. Gill, communicated to me a case of the poisoning of an infant, only four and a half days old, by a small quantity of this liniment. The case occurred in Sept. 1863. Mr. Gill saw the infant about half an hour after the liquid had been taken; it was then screaming in a suppressed manner, as if the act increased the pain: the hands were tightly clenched; the skin was pale and covered with a cold perspiration: the mucous membrane of the lips was blistered, and that of the mouth and tongue was white. A yellowish froth escaped from the mouth and nostrils; breathing was painful, and the pulse imperceptible. In about two hours the infant appeared better, but at intervals it suddenly started and screamed, as if from sudden pain. In six hours it continued much in the same state, and swallowing was painful. In seventeen hours the skin was moist and cool: it had had a natural motion, and had been in a drowsy state during the night. After twenty-four hours the infant was much weaker; the limbs were cold, and the breathing was feebly performed. It became drowsy, and died thirty-two hours after taking the poison. There was an inquest, but no inspection of the body. A question of importance arose in reference to the case: namely, whether the mother or a child, two rs of age, administered the poison to the deceased infant. The mother ed that this child was playing with the bottle of embrocation on the bed, which her infant was lying. She left the room for a short time, and on her urn she gave the infant a teaspoonful of food which she had previously pared for it. She was sure the infant swallowed part of the food; but soon as the food was taken, it screamed violently and struggled for its ath, and then she perceived the food to smell strongly of the embrocation. from the nature of this irritant compound the symptoms could not be pended, it is clear that the mother either consciously or unconsciously gave poison to her infant. On the latter supposition, it must have been placed he food which was on a chair near to the bed by the child of two years, ing her absence; but in this case it is remarkable that she did not per- e the odour until after she had poured the liquid into the mouth of the nt. The quantity swallowed was unknown. In the 'Medical Times and ette' for May 26, 1855, there are two cases reported, in which children e poisoned by swallowing a liniment of ammonia and oil. In one, an nt, death occurred speedily, probably from swelling and closure of the air sages, thus leading to suffocation. In the other case, death took place on following morning. Considering the hot taste of ammonia, it is remark- that an infant could have had the power of swallowing nearly two ounces strong ammoniacal liniment. It had been poured down its throat by ther child of five years of age. A solution of strong ammonia has been iciously used for throwing on the person. It must be regarded as a corro- liquid, capable of producing serious injury.

arbonate of Ammonia.—The solution of this salt (sal volatile) is probably e active as a poison than is commonly supposed. The following case oc- ed to my knowledge in 1832. A man, in a fit of passion, swallowed about fluid-drachms of a solution of sal volatile. In ten minutes, he was seized stupor and insensibility; but upon the application of stimulant remedies, ecovered. He suffered for some time afterwards, from severe irritation t the throat and gullet. Mr. Iliff, jun., has reported the case of a little aged two years, who swallowed about half an ounce of strong solution of ts of hartshorn, and in spite of rather severe symptoms recovered in a few . ('Lancet,' Dec. 1, 1849.)

a paper above referred to (p. 181), Dr. Barclay relates the case of a le, æt. 19, who, while in a state of unconsciousness, was made to swallow antity of hartshorn. She felt a severe pain in the stomach immediately, in about an hour afterwards she vomited some blood. This vomiting of l continued for several days. These symptoms were followed by great bility of the stomach, and the constant rejection of food. There was nate constipation of the bowels, with great emaciation and loss of strength. lied in about three months from the time at which she had swallowed the ine poison. On inspection, the gullet was found healthy; the orifice, at nction with the stomach, was slightly contracted. The intestinal orifice contracted to the size of a crowquill, and the coats were thickened. On osterior wall of the stomach there was a dense cicatrix of the size of -crown, and from this point fibrous bands ramified in various directions. duodenum and other parts of the intestinal canal were healthy. ('Med. s and Gazette,' Nov. 26, 1853, p. 554.) A case occurred to Mr. Procter, y, 1852, in which a woman gave to her infant, four weeks old, a tea- ful of hartshorn of the strength of about nine per cent. The child ne more and more depressed, and died thirty-six hours after taking the . There was no vomiting or purging, and the mouth and throat pre- l no excoriation; there was, however, slightly increased redness of the membrane. An examination after death was not made.

The salts of ammonia are not often used by persons who are intent upon suicide or murder, but there is one instance on record in which a man was tried for the murder of a child by administering to it spirits of hartshorn. (*Regina* v. *Haydon*, Somerset Spring Assizes, 1845.) Of the action of the other compounds of ammonia on man, nothing is known.

Chemical analysis.—The three alkalies, potash, soda, and ammonia, are known from the solutions of the *alkaline earths* by the fact that they are not precipitated by a solution of carbonate of potash. They all three possess a powerful alkaline reaction on test paper, which, in the case of ammonia, is easily dissipated by heat. Ammonia is immediately known from potash and soda by its odour and entire volatility. The *Carbonate of Ammonia* may be known from other salts by its alkaline reaction, its odour, and its entire volatility as a solid:—from pure ammonia, 1, by its effervescing on being added to an acid; 2, by its yielding an abundant white precipitate with a solution of chloride of calcium; from the carbonates of potash and soda, among other properties,—1, by its giving no precipitate with a solution of the sulphate of magnesia; 2, from the rich violet blue solution which it forms when added in excess to the sulphate of copper; 3, by its odour and volatility.

CHAPTER 16.

POISONING BY NITRE, SULPHATE OF POTASH, AND IODIDE OF POTASSIUM—CHLORIDE OF BARIUM—CARBONATE OF BARYTA.

Nitrate of Potash, Nitre, Saltpetre.

Symptoms and Appearances.—This well-known salt has on several occasions destroyed life, but only when taken in large doses. In a case which is reported by Orfila, a lady swallowed by mistake for other salts, an ounce of the nitrate of potash. In a quarter of an hour there was vomiting and purging, the muscles of the face were convulsed, the pulse was weak, the respiration difficult, and the limbs were cold; and there was a sense of burning heat and severe pain at the pit of the stomach. She died in *three hours*. On inspection, the stomach was found highly inflamed, and the membrane detached in various parts. Near the pylorus, the inflammation had a gangrenous character. A large quantity of bloody liquid was found in the stomach. (i. 283.) In another case, which proved fatal in sixty hours, where an ounce and a half of nitre had been taken, a small perforation was found in the stomach. (Ib.) Dr. Geoghegan, of Dublin, met with the following case:—A man took from an ounce to an ounce and a half of nitre by mistake for salts. Severe pain in the abdomen followed, with violent vomiting, but no purging so far as could be ascertained. He died in about *two hours* after taking the salts. On examining the body, a bloody mucus was found in the stomach, and the lining membrane was of a brownish-red colour, generally inflamed, and in parts detached from the coat beneath. None of the poison could be detected in the stomach; but its nature was clearly established from the analysis of a portion left in the vessel which had contained the draught. Two men swallowed, each, one ounce of nitre by mistake for Glauber's salt. They almost immediately experienced a sense of coldness in the course of the spine, trembling in the limbs, with violent vomiting and purging. The evacuations were bloody. They recovered in the course of a few days. (Casper's 'Wochenschrift,' xviii. 1841.) A case is reported in the same journal, in which one ounce of nitre killed a man in thirty-six hours. In another case an old man, æt. 60, lost his life from an overdose of nitre which he had taken as a medicine. The dose amounted to about ten drachms: it caused profuse purging, and death in about five hours. Death was referred to inflamman of the mucous membrane of the stomach and bowels, owing to the tant action of the nitre. A female, æt. 28, swallowed in two doses, taken two days, about an ounce of nitrate of potash. After the second dose, she attacked with severe burning pain in the stomach, and violent vomiting owed by collapse. There was no purging, and the secretion of urine was ested. The girl recovered in a few days. ('Pharm. Journal,' Feb. 1846, 56.) Mr. Gillard met with a case in which a man recovered in four days r having swallowed two ounces of nitrate of potash by mistake for Epsom s. In about five minutes after taking the nitre, he felt a burning pain in stomach, and this was immediately followed by sickness. Free vomiting excited by mustard; this probably led to his recovery. ('Prov. Med. rn.' Aug. 19, 1846, p. 382.)

here appears to be some uncertainty in the action of this salt, both as to the nptoms and the fatal effects on the body. Mr. Fuller, of Oswestry, comnicated to me a case which proved fatal in December, 1863. A man llowed an ounce of nitre, mixed with water, by mistake for Epsom salts, ut nine o'clock in the morning. It produced vomiting with severe pain, no purging. There was coldness of the surface and lividity of the face. th took place in three hours. On inspection the mucous membrane of stomach was found highly inflamed, especially towards the middle of the ter curvature, where, for several inches, it resembled scarlet cloth. The rus and duodenum were of a deep crimson colour. The peritoneal surface very vascular, especially over the stomach, the vessels having a vermilion colour, as if they had been injected. The heart and lungs were healthy, blood was fluid and more florid than natural. The other organs presented nusual appearance. No analysis was made of the contents of the stomach, that the nitre was the cause of death no doubt could be entertained, and rdict was returned accordingly at the coroner's inquest.

nalysis.—For the chemical properties and method of detecting this salt, page 172.

SULPHATE OF POTASH.

ymptoms and Appearances.—A lady, about a week after her delivery, took, he prescription of her medical attendant, about ten drachms of the hate of potash in divided doses, as a laxative. After the first dose, she seized with severe pain in the stomach, nausea, vomiting, purging, and ps in the limbs. These symptoms were aggravated after each dose: lied in *two hours.* It was supposed that some poison had been given by ake; but that was not the case, and the question was, whether her death or was not caused by the sulphate of potash. On an inspection of the , the mucous membrane of the stomach and intestines was pale, except e valvulæ conniventes, (folds,) in which it was reddened. The stomach ined a large quantity of a reddish-coloured liquid, which, on analysis, was l to contain only sulphate of potash, and no trace of any common irritant n. The examiners referred death to sulphate of potash taken in an ually large dose, whereby it had acted as an irritant poison on a person e constitution was already much debilitated. ('Ann. d'Hyg.' Avril .)

e question whether this is to be regarded as an irritant poisonous salt or vas much debated among members of the profession, in reference to a which was tried at the Central Criminal Court in October 1843. (The v. *Haynes.*) The accused had given to the deceased, the night before eath, two ounces of sulphate of potash, dissolved in water; and it was d that a fortnight previously to this, she had taken in divided doses, as as a quarter of a pound of the salt. The woman thought that she was pregnant, but this was disproved by an examination of the body; and it was charged that the prisoner had given her the salt with the intention of causing a miscarriage. After the last dose, she was seized with sickness, and died within a very short time. The stomach was found empty, but highly inflamed; and there was blood effused on the brain. One medical witness referred death to the action of this salt as an irritant poison; the other to apoplexy, as an indirect result of the violent vomiting caused by it. The prisoner was acquitted of the charge of murder, but subsequently found guilty of administering the sulphate with intent to procure abortion. Both of the witnesses admitted that, in small doses, the salt was innocent; but that in the dose of two ounces, it would produce dangerous effects. A case, somewhat similar in its details, was the subject of a trial at the Central Criminal Court in October, 1856. (*Reg.* v. *Gaylor.*) A married woman, the wife of the prisoner, under the belief that she was pregnant, took a large quantity of this salt, the prisoner having purchased two ounces, and handed it to her. It was taken with the design of procuring abortion, but it caused the death of the woman under symptoms of severe irritation of the stomach and bowels. The deceased was not seen by a medical man while living, but she suffered from severe pain, vomiting, and purging: the vomited matter had a bilious colour. On inspection, the stomach and the upper portion of the small intestines were of a deep purple colour, as if from the action of some irritating substance. The stomach, when opened, showed marks of irritation, and its mucous coat was much congested. In this organ there was a spoonful of a thick, slimy fluid, which contained a quantity of sulphate of potash. The intestines contained twelve ounces of a thick white fluid, highly charged with mucus, and this, when analysed, yielded sulphate of potash. There was no doubt that death had been caused by an overdose of this salt.

According to Mr. Mowbray ('Medical Gazette,' vol. 33, p. 54), sulphate of potash is much employed in France as a popular abortive. He quotes several instances in which, in large doses, it produced severe symptoms, resembling those of irritant poisoning, and even death. In one case, two drachms acted powerfully; and in another that fell under his own observation, four drachms of the salt, administered to a lady after her confinement, had all the effects of an irritant poison. The above cases are the only instances in which, I believe, it is publicly known to have proved fatal in England; and they show that substances, commonly regarded as innocent, may sometimes give rise to important questions in toxicology.

There is no doubt that the most simple purgative salts may, under certain circumstances, and when given in large doses, destroy life. A case is elsewhere related, in which sulphate of magnesia caused death, and gave rise to a criminal charge in this country. ('ON POISONS,' 2nd ed. p. 4.) It is said that sulphate of potash has in some cases caused vomiting and other serious symptoms, from its containing as impurity sulphate of zinc. This, if present, would be easily discovered by the appropriate tests.

Chemical Analysis.–Sulphate of potash is easily identified. It is a dry hard salt, soluble in water, forming a neutral solution. This solution, if sufficiently concentrated, is precipitated both by tartaric acid and perchloride of platinum, whereby potash is indicated; and the presence of sulphuric acid is known by the action of a salt of baryta. *Organic liquids.*—This salt being insoluble in alcohol, may have the organic matter removed from it by treating the liquid containing it (previously concentrated) with alcohol:—or the substance containing the salt may be evaporated to dryness and incinerated, when the undecomposed sulphate may be obtained by lixiviating the calcined residue with distilled water. The sulphate of potash exists naturally in some animal fluids, but only in traces.

Iodide of Potassium.

Symptoms.—This salt is extensively employed as a medicinal preparation, it appears to have given rise, in some instances, to alarming symptoms, n when exhibited in small doses; and it is stated that death has resulted n its use. The following cases will perhaps serve to illustrate its alleged ious effects. A gentleman was ordered by his physician to take three ins of the iodide in a draught of peppermint water three times a day. After third dose he felt unwell; and an hour after the fourth dose he was cked with a violent shivering fit, followed by headache, hot skin, intense st, quick and full pulse, with vomiting and purging. These symptoms were eeded by great prostration of strength. In spite of treatment, the purging ed several days. The effects of the medicine in this case were so violent, ough only *twelve grains* had been taken, that there is little doubt, if patient had taken another dose, he would have died. ('Med. Gaz.' Sept. 841.) In October, 1841, a case was reported by Mr. Erichsen to the versity College Medical Society, in which alarming symptoms resulted n the exhibition of only *five grains* of iodide of potassium. There was t difficulty of breathing, discharge from the eyes and nostrils, inflamed unctivæ, and most of the symptoms of violent catarrh. The iodide was ontinued and the patient recovered. Dr. Lawrie found that seven grains a half of the iodide, in three doses, produced in an adult, dryness and ation of the throat, great difficulty in breathing, and other serious ptoms. In another instance, thirty grains, in divided doses, caused severe ache and secretion of tears. In two instances, wherein he had prescribed nedicinally in small doses, it was, in his opinion, the cause of death. ed. Gaz.' xxvii. p. 588.) These cases show the necessity of caution in the cinal use of this substance. The effects from small doses may, perhaps, be buted to idiosyncrasy; still there seems to be good ground, from the results xperiments on animals, for ranking iodide of potassium among noxious nt substances. It has not, so far as I know, caused death, if we except the cases recorded by Dr. Lawrie. One drachm and a half of the solution been taken by a young female without destroying life, although it pro- d serious symptoms of irritation. (Devergie, 'Méd. Lég.' ii. 536.) It has suggested that the occasional adulteration of the iodide with carbonate of h may account for the discrepant statements respecting its poisonous pro- es. In one instance, in which the medicinal dose had been carried to several ms, the iodide was found to contain seventy-five per cent. of the carbo- of potash. This may explain the fact that large doses of the iodide been given by French surgeons in the treatment of syphilis without pro- g injurious consequences. M. Payen has prescribed as much as sixty s a day in divided doses, and M. Ricord is stated to have carried the dose e hundred and thirty-five grains in a day. Another theory, however, e adopted to account for the innoxious character of these large doses. A of tolerance may have been set up as in the administration of tartar c in cases of pulmonary disease.

emical Analysis.—The iodide may be distinguished by its cubic crystals y its solution producing a blue colour with starch on the addition of nitric acid. The salt gives a violet colour to flame, indicative of potash, ields iodine when treated with sulphuric acid and oxide of manganese.

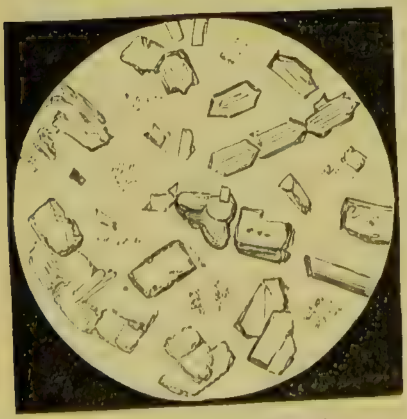
Salts of Baryta.

oride of Barium.—*Symptoms.*—A woman, æt. 23, took by mistake for n salts less than a teaspoonful (100 grains) of the chloride. This was at 1st October, 1858. In half-an-hour there was a feeling of deadly sickness, with sharp burning pains in the stomach and bowels. Vomiting and purging set in violently, the purging being attended with straining. An hour and a half after she had taken the poison the following symptoms were observed by Mr. Walsh. Face pale and anxious, eyes deeply sunk, surface cold, heart's action feeble, pulse scarcely perceptible, tongue natural and warm, loss of muscular power, sensation and intelligence not affected, pupils natural. Fluids taken were instantly rejected with a ropy mucus. There was pain in the stomach, singing in the ears, twitching of the face, and twisting of the legs and arms. At 9 P.M. the symptoms had abated, but at 2 A.M., (*i.e.* in about fourteen hours) the purging had returned, and the symptoms were much worse. There was a loss of voluntary muscular power. The breathing was slow and laboured, and indicated effusion in the bronchial tubes, but the woman was sensible. Soon after 3 A.M. she was convulsed, and these convulsions continued in paroxysms for two hours, when she died, seventeen hours after taking the poison. During the fits she had several watery evacuations, and consciousness was lost. There was no *post-mortem* examination. ('Lancet,' 1859, vol. 1, p. 211.) A case of poisoning by this salt is reported by Wildberg. The symptoms were those of irritation, combined with an affection of the brain and nervous system. Giddiness, convulsions, and paralysis, have been remarked among them. In the case referred to, half an ounce proved fatal in two hours: in another instance, one ounce taken by mistake for Glauber's salt, destroyed life in *an hour.* In small doses, even, the chloride has been observed to affect the system powerfully. Orfila found that the chloride of barium was absorbed: he detected it in the liver, spleen, and kidneys of animals poisoned by it. ('Ann. d'Hyg.' 1842, ii. 217.)

The *Carbonate of baryta* is said to have destroyed life in two cases, in each of which only one drachm was taken; but the following case, which occurred to Dr. Wilson, shows that this compound is not so poisonous as the chloride. A young woman swallowed half a tea-cupful of the powdered carbonate, mixed with water, at a time when she had been fasting twenty-four hours. There was no particular taste. In two hours, she experienced dimness of sight, double vision, ringing in the ears, pain in the head, and throbbing in the temples, with a sensation of distension and weight at the pit of the stomach. There was also palpitation of the heart. After a time she complained of pain in the legs and knees, and cramps in the calves. She vomited twice a fluid like chalk and water. The skin was hot and dry, the pulse frequent, full, and hard. These symptoms gradually abated, and she recovered, although the pain in the head and stomach continued for a long time. ('Med. Gaz.' xiv. 448.) The carbonate is used as a poison for rats and mice.

Analysis.—Chloride of barium crystallizes in plates: it is soluble in water. 1. The solution yields an insoluble white precipitate with sulphuric acid or an alkaline sulphate. This precipitate is nearly insoluble in nitric acid. 2. The powdered salt, burnt on platinum wire in a smokeless flame, imparts to it a greenish yellow colour. 3. Chlorine may be detected by a solution of nitrate of silver. (See p. 173.)

Carbonate of baryta is a white insoluble powder. It is entirely dissolved with effervescence (carbonic acid) by diluted hydrochloric acid. On evaporation, it yields crystalline plates of the chloride of barium, which may be tested by the processes above mentioned.



Crystals of Chloride of Barium, magnified 30 diameters.

CHAPTER 17.

PHOSPHORUS—SYMPTOMS AND APPEARANCES—CHRONIC POISONING BY THE VAPOUR—FATAL DOSE—CHEMICAL ANALYSIS—PHOSPHORUS-PASTE—RED OR ALLOTROPIC PHOSPHORUS.

Symptoms.—Phosphorus acts as an irritant poison, but its operation is attended with some uncertainty, according to the state in which it is taken. The symptoms are frequently slow in appearing: it is only after some hours, and sometimes even one or two days, that signs of irritation with convulsions and spasms appear; but when these once come on, the case proceeds rapidly to a fatal termination. In the first instance the patient experiences a disagreeable taste resembling that of garlic, which is peculiar to this poison. An alliaceous or garlic odour may be perceived in the breath. There is an acrid burning sensation in the throat, with intense thirst, nausea, severe pain and heat with a pricking sensation in the stomach, followed by distension of the abdomen and frequent vomiting. The vomited matters are black or of a dark green colour, and have the odour of garlic: white vapours may be seen to proceed from them, and in the dark, they may even appear phosphorescent. Purging has been noticed among the symptoms, and the motions have been observed to be luminous in the dark. The pulse is small, frequent, and scarcely perceptible. There is great prostration of strength, and coldness of the skin with other symptoms of collapse. The patient may die quietly, or be convulsed before death.

A woman, æt. 26, swallowed a decoction of lucifer matches in coffee. In an hour an emetic was given to her, and she vomited half a pint of clear glairy fluid, having the smell of phosphorus, and containing particles of blue colouring matter (Prussian blue) derived from the matches. She had no pain in the stomach, and no purging. In four days she appeared to have recovered; but about this time there was bleeding from the nose; she was jaundiced, and blood appeared in the matter vomited. Febrile symptoms set in with purpura, and she died in about a week after taking the poison. ('Ed. Monthly Journal,' Oct. 1860.)

On the 20th April 1861, a girl swallowed a quantity of phosphorus paste. When seen soon afterwards by Mr. Parsons of Bridgewater, her lips as well as parts of her dress were smeared with this substance, and there was a strong odour of phosphorus in her breath. Her countenance was tranquil: her pulse regular: there was no sickness or nausea, and she complained of nothing but slight thirst. Her symptoms were so slight that they excited no suspicion that the girl had swallowed the poison. She passed a restless night, and the next day she complained of heat in the mouth and throat, and of a slight sensation of nausea and retching. There was no pain or tenderness in the region of the stomach, the pulse was regular but weak. On the 22nd she dressed herself and was able to walk about the ward: she left the hospital and went home, having walked a mile: she had her tea as usual at night, and went to bed. On the following day, the 23rd, she complained of pain in her bowels with sickness and purging. These symptoms became worse. On the 25th, there was pain in the bowels, which were tender on pressure and slightly tympanitic. The pulse was intermittent, and the girl was fast sinking. She died on the 26th, having survived the effects of the poison nearly a week, and no well-marked symptoms having set in until *the fifth day.* An inspection of the body was not permitted, and the only fact observed after death was a tendency to rapid putrefaction. The whole of the body became speedily livid, and the finger-nails were blue—a condition noticed by a witness to have existed before death.

It will be perceived that, in reference to the delay in the appearance of symptoms, their slightness taken as a whole, and the time at which death occurred, this case is similar to the one previously related. If it were not for the peculiar character of the circumstantial evidence, these cases might easily throw a practitioner off his guard in forming an opinion. The odour of the breath, and the appearance of phosphorus smeared over the dress, first attracted the notice of Mr. Parsons. Other witnesses deposed that whatever deceased touched with her hand, seemed to take fire, and that when she drank water to allay her thirst, a kind of smoke issued from her mouth. Her hands and dress were luminous in the dark.

Phosphorus-vapour. Chronic poisoning.—Chronic poisoning by phosphorus is accompanied by nauseous eructations, frequent vomiting, a sense of heat in the stomach, purging, straining, pains in the joints, wasting, hectic fever, and disease of the stomach, under which the patient slowly sinks. Some interest is attached to the chronic form of poisoning by phosphorus from the researches of Dr. Strohl and others, on the effects of the *vapour* upon persons engaged in the manufacture of phosphorus or lucifer matches. It has been remarked that such persons have suffered from necrosis of the jaw, carious teeth, and abscesses. There has been also great irritation of the respiratory organs, and bronchitis has frequently shown itself among them. These effects have been attributed to the respiration of the vapours of phosphorus, which are supposed, in becoming acidified, to act chemically upon the exposed portions of the teeth. (See 'ON POISONS,' 2nd edit. p. 345.)

Appearances.—Among the appearances produced by this poison are marks of irritation and inflammation in the stomach and intestines. The stomach has been found much contracted, and its mucous membrane inflamed, occasionally softened and presenting purple or violet-coloured spots. Inflammation of the stomach and bowels proceeding to gangrene, may be a result of the action of phosphorus. M. Worbe found the stomach perforated in three places in a dog which had been poisoned by a solution of phosphorus in oil. A man, æt. 50, took a quantity of phosphorus-paste used for destroying vermin. He was seen in his usual health at twelve o'clock P.M., and was found dead in a field the following morning. On inspection, it was observed that there was great muscular rigidity. The membranes of the brain were congested, and there was serous effusion between them. The substance of the brain was also congested. The heart was flaccid and nearly empty. The mucous membrane of the stomach, gullet, and small intestines was very red, and there were patches in which the membrane was destroyed. On opening the stomach a white vapour escaped, accompanied by a strong smell of phosphorus. This organ contained a tablespoonful of a viscid greenish matter, from which particles of phosphorus with some Prussian blue (used as a colouring for the poison), subsided on standing. (Dr. Bingley, 'Lancet,' June 13, 1857, p. 600.) Mr. Herapath states that in a case which he examined he found, besides inflammation of the stomach, the mucous membrane raised in small bladders or vesications. This was probably a change produced by putrefaction, as the body was not examined until twenty-three days after death. Such an appearance is frequently seen in the inspections of putrefied bodies, and has not been observed in cases of recent poisoning by phosphorus. Schuchardt describes, among the appearances, fluidity of the blood, which is of a dark colour, and does not become red on exposure to the air. Ecchymoses are sometimes found on the skin and on the surface of various organs. ('Brit. and For. Med. Rev.' 1857, vol. 19, p. 506. 'Journal de Chimie Médicale,' 1857, p. 84.)

In the case of the female described at page 191, who died after the lapse of a week, there was no inflammation, ulceration, or softening of the mouth, gullet, stomach, or small intestines. There was a red patch in the cæcum, and another in the colon (the large intestines). The contents of the stomach and intestines had a coffee-ground colour, like the liquid found in hæmatemesis (vomiting of blood). The brain was slightly congested. There were bloody effusions in the chest and abdomen, and an apoplectic condition of the soft organs. The vomited matters, when shaken in the dark, were phosphorescent and phosphorus was separated from them by sulphide of carbon.

The viscera, and even the flesh of animals recently poisoned by phosphorus, have the odour of garlic, and appear luminous in the dark. (Galtier, 'Toxicologie,' vol. 1, p. 184.) Mr. Clowes informed me, that in examining some fowls which had been poisoned with phosphorus, he was struck with the strong odour of this substance on opening the gizzards, and with the appearance of a fine white fume, which was luminous when observed in a dark room. In the case of a woman who died while taking phosphorus medicinally, it was remarked that the whole of the viscera of the body were luminous in the dark; thus indicating the extensive diffusion of the poison by absorption. (Casper's 'Wochenschrift,' 21 and 28 Feb. 1846, 115, 135.) For a further account of the appearances, see 'Chemist,' Jan. 1856, p. 244.

Fatal Dose.—That phosphorus is a powerful poison, is proved by two cases quoted by Dr. Christison. In one, death was caused by a grain and a half in twelve days; in the other, by two grains in about eight days. It has been supposed to operate as a poison only by becoming converted into phosphorous acid; but although this conversion takes place, it is probable that phosphorus passes directly into the blood, since the urine voided during life, has been observed to be luminous: hence it is itself probably a blood-poison. The production of phosphorous acid by its oxidation, may account for the erosions met with in the stomach and bowels.

Dr. Hartcop mentions that an apothecary took by way of experiment one grain; on the next day two grains, and on the third day three grains of phosphorus mixed with sugar. He was then seized with inflammation of the stomach and bowels, and died in spite of every attempt to save him. (Casper's 'Wochenschrift,' 1846, p. 117.) M. Chevallier refers to a case in which a dose of 2·3 grains proved fatal, and two other cases in each of which a dose of 4·6 grains destroyed life. The same writer quotes, on the authority of Löbenstein Löbel of Jena, the case of a lunatic who died from a dose of one-eighth of a grain. ('Ann. d'Hyg.' 1857, vol. 1, p. 422.) Excepting this, the smallest fatal dose which I have met with, is a case quoted by Galtier. A woman, æt. 52, took in divided doses, in four days, about six centigrammes, or less than *one grain*, of phosphorus dissolved. The largest dose taken at once, *i. e.* on the fourth day, is stated to have been three centigrammes (0·462 grain), or less than half a grain. Symptoms of pain and irritation appeared, and the patient died n three days. The gullet, stomach, and small intestines, were found much nflamed. ('Toxicologie,' vol. 1, p. 87.) When the phosphorus is dissolved n any liquid, or when it is finely divided, as in phosphorus-paste or in lucifer matches, its action is then more powerful, as it is in a state well fitted for bsorption.

The earliest period at which death has taken place is *four hours*. This was in a case related by Orfila, of a young man in weak health, who took a dose of this poison. The same author mentions a case in which death did not take place until after the lapse of seventeen days. In general, several days elapse before a fatal result takes place, and during this time the patient undergoes much suffering. This was observed in a young female who swallowed a quantity of phosphorus-paste intended for poisoning rats. She did not die ntil the fifth day. ('Journal de Chimie Méd.' 1845, p. 580.)

Chemical Analysis.—Phosphorus is a solid of waxy consistency, having a peculiar odour and taste resembling garlic. It is the odour and taste which prevent it from being criminally employed as a poison, and render it easy of detection in articles of food. It evolves a white vapour in daylight, and a faint bluish luminosity in the dark. It melts and takes fire at a temperature of 113°, burning with a bright yellow flame, and producing thick white acid vapours by combustion. It is not soluble in water, but water in which it has been preserved or washed, acquires poisonous properties by reason of the phosphorous acid formed. ('Ann. d'Hyg.' 1857, vol. 1, p. 423.) It is dissolved by alcohol, ether, chloroform, and the oils, but especially by sulphide of carbon.

Organic Mixtures.—The smell which phosphorus imparts to organic substances is remarkably characteristic. When it has been taken in a solid form the particles may be separated as a sediment, by washing the contents of the stomach in water. These may be melted under water into one mass, either by plunging the tube containing them into hot water, or by pouring hot water upon them in a glass. If a portion of the organic liquid is exposed in the dark, the particles of phosphorus will be easily recognised by their luminosity, as well as by their combustion when the surface on which the material is spread, is heated. Phosphorus is very soluble in sulphide of carbon, and it may be separated from many organic matters by digestion with this liquid. It is thus procured from flour and phosphorus-paste, or from the residue of the contents of the stomach after washing and decantation. On the spontaneous evaporation of the sulphide, decanted from the organic liquid or solid, the phosphorus may be procured in small globules or beads. These are ignited when touched with a hot wire. A portion of the solution poured upon thin paper, ignites spontaneously when dry, and burns with its well-known flame. If the phosphorus is in a state of solution or is in too small quantity to be dissolved out of the material by sulphide of carbon, its presence may be indicated by distilling the liquid containing it in the dark—the boiling point being raised by the addition of sulphuric acid. The vapour appears luminous as it is condensed. In a case which occurred to Mr. Herapath, this chemist failed to detect any trace of phosphorus in a body on the twenty-third day after death: hence, like other poisons, it is liable to disappear. Phosphorus readily undergoes oxidation in the body, and is thus converted into phosphorous or phosphoric acid. M. Blondlot has suggested a process for its detection when this conversion into phosphorous acid has taken place. It depends on a peculiar green colour which the lower oxides of phosphorus give to the flame of hydrogen when burnt. (See 'Journal de Chimie,' 1862, p. 528, also a paper by Dr. Ludwig, 'Journal de Chimie,' 1863, p. 581.)

Red or *Allotropic Phosphorus.*—The remarkable substance, known under the name of allotropic phosphorus, is not possessed of poisonous properties. This fact, long since announced by Liebig ('Letters on Chemistry,' 165), has been confirmed by experiments at the Veterinary College at Alfort. ('Ann. d'Hyg.' 1857, vol. 1, p. 432.) Common phosphorus is poisonous in doses varying from one to three grains, while allotropic phosphorus has been given to animals in doses of thirty grains without causing symptoms of poisoning. This kind of phosphorus, by reason of its being generally in a fine powder, is in a state more favourable for acting as a poison than common phosphorus, and yet, owing probably to its insolubility, it is inert. M. Bussy in 1850, and M. de Vrij in 1851, proved that a dog might take with impunity thirty grains. Orfila and Rigaut have given it to animals in doses amounting to some ounces, over a period of twelve days, without producing any noxious effects. (See 'Annuaire de Thérapeutique,' 1855, p. 103.) That it does not act as a poison in the human body, appears to be established by the facts of a case reported in the 'Edinburgh Monthly Journal' for October, 1860. A woman, æt. 26, swallowed the composition scraped from a number of lucifer matches: it turned out that these were made with allotropic phosphorus. She suffered no inconvenience. She procured other matches of common phosphorus, took a decoction of them in coffee, and she died from the effects.

Analysis.—Allotropic phosphorus is easily recognized by heating it, or any mixture containing it, to about 500°, when it burns like common phosphorus, and yields similar products. It is insoluble in all liquids, and by its insolubility in sulphide of carbon, it is distinguished and separated from common phosphorus. It has no odour or taste, and is not luminous in the dark, unless it contains common phosphorus. In any analysis for phosphorus, we must take care to exclude it by employing sulphide of carbon as a solvent for the common or poisonous form of phosphorus. (The reader will find a full account of the comparative effects of the common and allotropic phosphorus by M. Chevallier in the 'Annales d'Hygiène,' 1856, vol. 1, p. 374. See also the same Journal, 1859, vol. 2, p. 370, and Casper's 'Vierteljahrsch,' 1860, vol. 2, p. 185.)

METALLIC IRRITANTS.

CHAPTER 18.

ARSENIC—ARSENIOUS ACID—SYMPTOMS—CHRONIC POISONING—APPEARANCES AFTER DEATH—FATAL DOSE—CHEMICAL ANALYSIS—ARSENITES—ARSENIC ACID—ORPIMENT AND OTHER COMPOUNDS.

WHITE ARSENIC. ARSENIOUS ACID.

THE term WHITE ARSENIC is commonly applied to the arsenious acid of chemists. It is seen under the form of a white powder, or in opaque brittle masses resembling enamel. It is called an acid from its power of combining with alkalies, but it possesses a feeble acid reaction when dissolved in water. It is often described as having an *acrid taste*, but this does not appear to be correct; a small quantity of it has certainly no appreciable taste, a fact which may be established by direct experiment, and might be inferred from its sparing solubility in liquids. It would appear from numerous cases on record, that it has been unconsciously taken in fatal quantities, in all descriptions of food, without exciting the least sensation on the tongue. Most of those persons who have been criminally or accidentally destroyed by arsenic, have not been aware of any taste in taking the poisoned substance. In cases in which the powder has been taken in *large* quantity, it is described as having had a *roughish* taste. Water boiled for an hour on the poison and allowed to cool, holds dissolved the 40th part of its weight, or about twelve grains in one ounce. If boiled for a shorter time not more than 1-80th part will be dissolved. Cold water allowed to stand for many hours on the poison does not dissolve more than from the 1000th to the 500th part of its weight; *i.e.* one half grain of arsenic to nearly one fluid-ounce of water. When arsenic in powder is mixed with cold liquids, a portion of the powder adheres to the sides of the vessel. This has sometimes given rise to a suspicion of poisoning.

Arsenic, as it is sold to the public in small quantities, ought to be mixed either with 1-16th part of its weight of soot, when it is of a greyish colour; or 1-32nd part of its weight of indigo, and then it is blue. Both of these colours are rendered much deeper when the powder is wetted, so that the sooty compound is nearly black. The act regarding the colouring of arsenic 14 Vic. c. 13, s. 3) is frequently evaded. It is sometimes sold uncoloured under the name of *mercury.*

Symptoms.—These will vary according to the form and dose in which the poison has been administered. The time at which they come on, is generally in from half an hour to an hour after the poison has been swallowed. This is the average period. I have known them to appear in a quarter of an hour. Dr. Christison mentions one instance in which the symptoms began in eight minutes; but in the case of *Lofthouse*, tried at the York Lent Assizes, 1835, the symptoms were proved to have attacked the deceased while he was in the act of eating the cake in which the poison was administered. On the other hand, in an instance communicated to me by Mr. Todd, where one drachm had been taken on an empty stomach, no symptoms appeared for two hours; in a case reported by Orfila, the symptoms did not show themselves for five hours; and in another that occurred to Dr. Lachèse, in which a large dose was taken, the symptoms did not come on for seven hours. ('Ann. d'Hyg.' 1837, vol. 1, p. 344.) Dr. Thompson, of Liverpool, states that he met with a case in which from thirty to forty grains of arsenious acid, and the same quantity of chrome yellow were taken. Symptoms of poisoning did not appear until five or six hours afterwards. ('Med. Chir. Rev.,' Jan. 1854, p. 294.) There may be every variety between these extremes. In one case their appearance was protracted for *ten* hours, the maximum period yet known. A remarkable instance occurred to M. Tonnelier, in which the poison was taken by a young female at eleven o'clock in the morning, and no well-marked symptoms occurred for *eight hours*: there was then violent vomiting. After death, a cyst, formed of mucous membrane and containing arsenic, was found in the stomach: the poison having thus become sheathed over! ('Flandin,' vol. 1, p. 535.) In a case communicated by Mr. Clegg to the 'Medical Times' (Oct. 21, 1848), symptoms of violent irritation did not show themselves until twenty-three hours after the poison had been taken, and within about half an hour of the death of the patient. The girl was once sick shortly after having taken the poison, but the first symptoms were those of narcotism. The girl was a confirmed opium-eater, and this habit may in some measure have influenced the operation of the poison. From a case communicated to the 'Medical Gazette' by Dr. W. Burke Ryan (vol. 47, p. 722), it appears that the active symptoms of irritation which commonly attend arsenical poisoning, may not appear until after the lapse of *nine hours* from the time at which the poison has been swallowed. With the exception of one case recorded in my work 'On Poisons (Arsenic)' in which the interval was ten hours, this is the longest period of protraction on record. In other instances there have been great intermissions. In all cases in which arsenic enters the system from without, as by its application to the skin, or to ulcerated or diseased surfaces, the symptoms are rarely manifested until after the lapse of some hours or even days. (See page 199.)

The individual first experiences faintness, depression, nausea, and sickness, with an intense burning pain in the region of the stomach, increased by pressure. The pain in the abdomen becomes more and more severe; and there is violent vomiting of a brown turbid matter, mixed with mucus, and sometimes streaked with blood. These symptoms are followed by purging, which is more or less violent, and this is accompanied by severe cramps in the calves of the legs. The matters discharged from the stomach and bowels have had in some instances a yellowish colour, as it was supposed, from a partial conversion of the poison to sulphuret, but more probably from an admixture of bile. The vomited matters are in some cases coloured with blood, and the mixture of blood with bile, has often given to them a green or brown colour. In other cases, they may consist of a large quantity of mucus ejected in a flaky state and having a milky-white appearance, as if from admixture with the poison. The *colour* of the vomited matters may be blue or black when coloured arsenic has been taken, or the admixture of bile may render them of a deep green colour. The vomiting is in general violent and incessant, and is excited by any liquid or solid taken into the stomach. There is tenesmus (straining), and the discharges by the bowels are frequently tinged with blood. There is a sense of constriction, with a feeling of burning heat in the throat, commonly accompanied by the most intense thirst. The pulse is small, very frequent, and irregular; sometimes wholly imperceptible. The skin is cold and clammy in the stage of collapse; at other times it is very hot. The respiration is painful from the tender state of the stomach. There is great restlessness, but before death, stupor sometimes supervenes, with paralysis, tetanic convulsions, or spasms in the muscles of the extremities. In one instance trismus (lock-jaw) appeared in three quarters of an hour. ('Orfila,' vol. 1, p. 449.). Although pain is in general among the early and well-marked symptoms, arsenic appears in some cases to destroy sensibility. Thus it has been observed, that even when the stomach has been found intensely inflamed after death, the patient complained of no pain during the time which she survived. (See case by Mr. Clegg, p. 198.)

Chronic Poisoning.—Should the person recover from the first effects, and the case be protracted, or should the dose have been small and administered at intervals, there will be inflammation of the conjunctivæ, with suffusion of the eyes, and intolerance of light, conditions which are, however, often present among the early symptoms above described. In a case reported by Mr. Jeffreys, an adult female died in three hours after taking arsenic in a pudding served at dinner. There was no vomiting or purging. In two hours she was in a state of complete collapse, and at this time it was noticed that the conjunctivæ (the membranes of the eyes) were red. ('Med. Times,' Aug. 30, 1851, p. 229.) There is also irritation of the skin, accompanied by a vesicular eruption, which has been called eczema arsenicale. Sometimes this has assumed the form of nettle-rash or of the eruption attending scarlet fever, for which disease arsenical poisoning has been mistaken! Local paralysis, preceded by numbness or tingling in the fingers and toes, and other symptoms of nervous disorder, are also common consequences. Exfoliation of the cuticle and skin of the tongue, with the falling off of the hair, has likewise been witnessed. (Case, of the *Turners*, 1815, Marshall, 119.) Salivation has been observed to follow, especially when small doses of the poison have been given for a length of time. ('Med. Gaz.' vol. 16, p. 790.) Strangury and jaundice have been noticed among the secondary symptoms. ('Marshall on Arsenic,' 44, 111.) A well-marked case of *slow poisoning* by arsenic is recorded by Flandin. ('Traité des Poisons, ou Toxicologie,' tom. 1, p. 510.) It illustrates a not unfrequent form of *secret* murder, and it is well calculated to inspire caution in making a diagnosis from symptoms. A woman put daily into the soup of her fellow-servant, a very small quantity of arsenious acid in powder. Shortly after dinner this person was seized with vomiting, which led to the rejection of the food and poison before the latter had caused any serious mischief. As this practice was continued at intervals for about six weeks, the stomach became exceedingly irritable; there was pain in the bowels, and the woman was much emaciated. There was also spitting of blood, with such a degree of nervous irritability, that a current of air falling upon her, caused an attack of spasms and convulsions. When the patient found that she could not bear anything on her stomach, she left the place and passed two months in the country. Her health became gradually re-established there, and she returned to resume her usual occupations. The prisoner, however, renewed her attempts; and to make sure of destroying life, gave to her one morning in coffee, a strong dose of arsenious acid in powder: violent vomiting ensued, and the poison was expelled with the food taken at breakfast. Arsenic was detected in the vomited matter, and the explanation of the cause of the long previous illness became clear. Under proper treatment the patient recovered. Such symptoms as those above described, may be easily referred to chronic inflammation, or ulceration of the stomach from natural causes, leading to perforation. There are many anomalous cases on record, in which the symptoms have diverged so much from the ordinary course as to embarrass medical practitioners. For some of these, I must refer to a paper by Dr. Ogston, 'Med. Gaz.' vol. 47, p. 181; also to my work 'ON POISONS,' 2nd Ed. p. 363.

Arsenic is not an accumulative poison; it is temporarily deposited in the organs after absorption, but is rapidly eliminated by the urine; and in from two to three weeks, if the person survives, the whole of it may be removed from the body.

Appearances after Death.—The striking changes produced by arsenic are generally confined to the stomach and bowels. They are commonly well marked in proportion to the largeness of the dose, and the length of time which the person has survived after taking the poison. Our attention must be first directed to the *stomach.* Arsenic seems to have a specific effect on this organ: for, however the poison may have entered into the system, whether through a wounded, diseased, or ulcerated surface, or by the act of swallowing, the stomach has been found inflamed. The mucous membrane of the stomach, which is often covered with a layer of mucus, mixed with blood or bile, and with a thick white pasty-looking substance containing arsenic, is commonly found red and inflamed in dotted or striated patches: the colour, which is of a dull or brownish red, becomes brighter on exposure to the air: at other times it is of a deep crimson hue, interspersed with black-looking lines or patches of altered blood. The redness is usually most strongly marked at the greater end; in one case it may be found spread over the whole mucous surface, giving to it the appearance of red velvet; in another it will be chiefly seen on the prominences or folds of the membrane. In one instance I found the coats thickened and of a gelatinous consistency, without any marked inflammatory redness.

The stomach has been found highly inflamed in a case which proved fatal in *two hours*. Thus it would appear that inflammation of the mucous membrane may be well marked within a very short period. This is confirmed by a case communicated to me by Mr. Clegg, coroner for Boston; it was the subject of an inquest before him in Sept. 1863. A woman, æt. 24, retired to her bed-room after dinner, at two o'clock, to lie down. At three o'clock she was not suffering from any apparent illness. At 4.30 she called to her sister, and then it was found that she had swallowed a quantity of arsenic. There was then no sickness. After this, she was sick once, and purged once, but complained of no pain. She drank some tea, but almost immediately became collapsed, and seemed to those who were with her to be falling into a fainting fit. She died before six o'clock, and was sensible to the last. She could not have taken the poison more than two hours before she died. On inspection the day following, the whole mucous membrane of the stomach was intensely inflamed, presenting a dark scarlet colour, with broad livid patches. Upwards of an ounce of solid arsenic was found in a pasty state on the mucous membrane of the stomach, which was raised, thickened, and velvety. This case shows not only that there may be extensive morbid changes in the dead body within a short period after the taking of the poison, but that with an unusually large dose, the symptoms of vomiting, purging, and pain may be slight and bear no proportion to the quantity of poison taken. Blood of a dark colour may be effused in various parts within the folds, or beneath the lining membrane, an appearance which has been mistaken for gangrene. A raised circular or oval patch of false membrane with an intensely red border and with arsenic upon its surface, may be sometimes seen upon the inner coat. [See the case of the *Queen* against *Dore and Spry*, C.C.C. August 28, 1848; also 'Med. Gaz.,' Nov. 24, 1848.] The stomach often contains a mucous liquid of a dark colour tinged with blood. The coats are sometimes thickened in patches, being raised up into a sort of fungus-like tumour, with arsenic imbedded in them: at other times they have been found thinned. The mucous membrane is rarely found ulcerated, and still more rarely gangrenous. Ulceration of the mucous membrane, as the result of the action of arsenic, has been found as early as ten hours after the poison had been taken. Perforation of the coats is so uncommon a result of arsenical poisoning, that there are but few instances on record. In a case examined by M. Chevallier, the stomach of a person who had died from the effects of arsenic, was found perforated at the larger end. The aperture is described to have been of the size of a franc piece, round, soft, and somewhat thickened in its margin. There was no redness or sign of erosion about it, nor was there any appearance of ulceration on the other parts of the mucous membrane. Externally the stomach was covered with false membranes, arising from inflammation of the peritoneum. ('Ann. d'Hyg.' 1852, vol. 1, p. 448.) This case is so imperfectly reported that it is impossible to say whether the perforation was caused by arsenic, or whether it was the result of previous disease. The mucous glands of the stomach have been found enlarged; but this is by no means an unusual morbid appearance from any cause of local irritation, without reference to poisoning. Various appearances are said to have been met with in the lungs, heart, brain and urinary organs; but they do not appear to be so characteristic of arsenical poisoning, as to admit of medico-legal use in enabling a medical man to distinguish poisoning from disease. It is to the stomach and intestines that he must look for the basis of reliable evidence in regard to appearances after death. Dr. Wilks met with an ecchymosed condition of the lining membrane of the left ventricle of the heart in a case in which a man died in twelve hours from acute poisoning by arsenic.

In a few instances the mouth, throat, and gullet have been found inflamed, but in general there are no changes in these parts to attract particular attention. The mucous membrane of the *small intestines* may be inflamed throughout, but commonly the inflammatory redness is confined to the upper part or to the duodenum, especially to that portion which joins the stomach. Of the large intestines, the rectum appears to be the most prone to inflammation. The liver, spleen, and kidneys present no appearances which can be connected with the action of arsenic, although these, like the other soft organs, may become receptacles of the absorbed poison. It is worthy of observation in relation to the known antiseptic properties of arsenic, that the parts especially affected by the poison (the stomach and intestines) occasionally retain the well-marked characters of irritant poisoning for a long time after death. Absorbed arsenic does not, however, appear to prevent the decomposition of the soft organs in which it is deposited.

Death from External Application.—Poisoning by the external application of arsenic is not very common. In February 1864, I was required to investigate a case of suspicious death which occurred near Halesworth in Suffolk. A girl, æt. 9, died rather suddenly, after an illness of about ten days. The mother had rubbed some precipitate ointment mixed with arsenic on the head of the child, which was diseased. Her object, she stated, was to kill the vermin on the scalp. No symptoms of note were observed until about the fifth day after the application, when the child appeared ill and complained of thirst. On the eighth day she was very unwell; there had been cramp, with slight action on the bowels, but no vomiting. She became drowsy, and died on the tenth day. Mr. Haward examined the body, and forwarded to me the viscera for a chemical analysis, the case being very obscure. The lining membrane of the stomach and duodenum was inflamed: in the stomach the inflammation was well marked towards the greater end: these were the principal post-mortem appearances. Traces of arsenic were found in the mucous fluids of the stomach, in the coat of the stomach and intestines, and in four ounces of the liver, but arsenic in a *solid* form could nowhere be detected. A portion of the diseased hairy scalp was examined, and yielded arsenic as well as mercury (from white precipitate), in large proportion, the arsenic being estimated at from two to three grains. From the evidence given at the inquest there was no doubt that the mother's account was correct, and that her child had died from the ignorant application of arsenic externally to a diseased portion of the scalp.

The remarkable features of the case were these: no symptoms appeared until after the fourth day, and then only great thirst; there was slight purging with cramps on the eighth day, and death took place on the tenth, without any vomiting. Arsenic was found in the stomach and contents, and its presence there might have led to an erroneous inference of its having been criminally administered by the mouth. It was, however, merely in traces, and obviously enough the result of mucous elimination. The nature and mode of occurrence of the symptoms were also opposed to any other presumption. That absorbed arsenic may be thus transferred from the blood to the stomach and intestines, has been distinctly proved by the experiments of Dr. Pavy and myself. ('Guy's Hospital Reports,' 1860, vol. 6, p. 397.)

Arsenic in Vapour.—It is not often that a case is heard of in which arsenious acid has caused death by reason of its having been breathed or swallowed in the state of vapour. In April 1858, a case involving the effects of arsenical vapours was the subject of an inquest in London (see 'ON POISONS,' 2nd edit. p. 234), but on that occasion, there was an entire failure of proof that the arsenical vapour was the cause of death. I am indebted to Mr. Oxley of Rotherham, for the account of a case that fell under his notice, which was the subject of a trial at the York Lent Assizes, 1864.

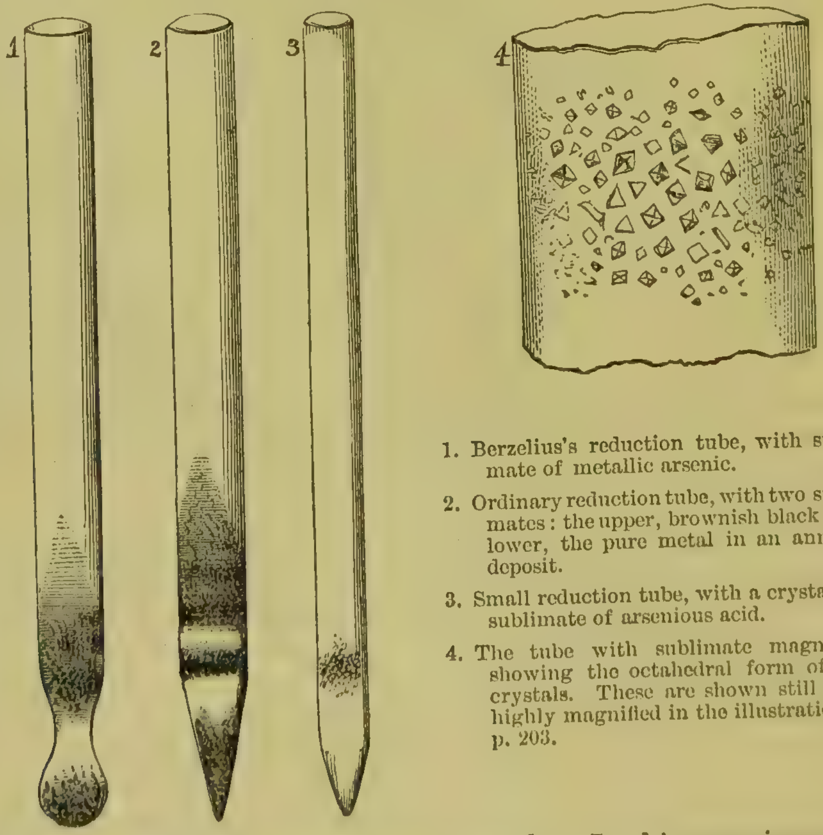
The prisoner placed some burning pyrites containing arsenic at the entrance of the door of a small room in which there were eight children, including an infant in a cradle. From the evidence, it appeared that all the children suffered from the fumes, which were chiefly those of sulphurous acid. A canary that was in a cage died from the effects. The children were speedily removed from the house and recovered, but the infant was left there for an hour. It suffered from vomiting, and when seen by Mr. Oxley about seventeen hours afterwards, the child was pulseless: it vomited incessantly, was much purged, and appeared to be in great pain. It died about twenty-four hours after exposure to the fumes. On inspection, the stomach and intestines were slightly inflamed. The brain and lungs were congested, and the lining membrane of the trachea was of a bright red colour. Dr. Allan detected arsenic in the contents of the stomach, in the lungs, in the coats of the stomach and the spleen. None was found in the liver. The pyrites contained arsenic, and gave off arsenious acid in vapour, and sulphurous acid while burning. Some of the appearances were owing to sulphurous acid, but death was probably caused by arsenic. The prisoner was found guilty of manslaughter.

Quantity required to destroy Life.—The smallest fatal dose hitherto recorded was observed in a case communicated by Dr. Castle, of Leeds, to the 'Provincial Journal,' (June 28, 1848, p. 347). A woman took half an ounce of Fowler's solution (arsenite of potash) in unknown doses, during a period of five days. She then died; and on examination the stomach and intestines were found inflamed. Death took place by syncope (mortal fainting), and there was an absence of vomiting and purging. The quantity of arsenic which here destroyed life, could not have been more than *two grains.* In another case, two grains and a half of arsenic, contained in two ounces of Fly-water, killed a robust healthy girl, aged nineteen, in thirty-six hours. (See 'Med. Gaz.' vol. 39, p. 116.) Hence under circumstances favourable to the operation of the poison, the fatal dose in an adult may be assigned at from *two to three grains*.

Period at which Death takes place.—Large doses of arsenic commonly prove fatal in from eighteen hours to three days. The average time at which death takes place is twenty-four hours; but the poison may destroy life within a much shorter period. There are now many authentic cases reported, in which death has occurred in from three to six hours. In 1845 I met with a well-marked case of death from arsenic in five hours; and in another, which occurred in April 1849, death took place in two and a half hours. ('Guy's Hospital Reports,' Oct. 1850, 183. See also 'Ann. d'Hyg.' 1837, vol. 1, p. 339.) Mr. Foster, of Huntingdon, met with the case of a child under three years of age, who died within *two hours* from the effects of arsenic. The quantity taken could not be determined. The most rapidly fatal case which I have met with was communicated to me by Mr. Thompson. It is that of a youth, æt. 17, who died in April 1860, from the effects of a large dose of arsenic—the symptoms from which he suffered being of a tetanic character. The poisoning was the result of an accident at Ramsey, in the Isle of Man. The medical evidence at the inquest was to the effect that not more than *twenty minutes* had elapsed between the time at which deceased sat down to eat his supper, containing the poison, and his death. In some instances death does not occur until long after the average period. In one case in which an adult swallowed about half an ounce, death did not take place for *fifty hours*, and it is remarkable that there was an entire absence of pain. ('Med. Gaz.' vol. 48, p. 446.) In the case of the *Duke de Praslin*, one large dose was taken, but death did not occur until the *sixth* day. ('Ann. d'Hyg.' 1847, vol. 2, p. 367.) In October 1847, a man who had swallowed 220 grains of arsenic was admitted into Guy's Hospital. He died on the *seventh* day. It is obvious that a patient who recovers from the first effects of this poison may still die from exhaustion or other secondary causes many days or weeks after having taken it, even although the whole of the poison has been eliminated from the body. Thus in the case of *Dr. Alexander*, death took place on the *sixteenth* day; and although a large quantity had been taken, no arsenic was found in the body. ('Med. Times and Gazette,' April 18, 1857, p. 389.) In one instance in which arsenic was applied externally to the head, the person did not die until the *twentieth day*. The longest duration of a case of poisoning by arsenic is probably that reported by Belloc. A woman, aged 56, employed a solution of arsenic in water to cure the itch, which had resisted the usual remedies. The skin became covered with an erysipelatous eruption, and the itch was cured, but she experienced severe suffering. Her health gradually failed, and she died after the lapse of *two years*, having suffered during the whole of this period from a general tremor of the limbs. ('Cours de Méd. Lég.,' 121.)

Chemical Analysis. Arsenic as a Solid.—In the simple state, *white arsenic* may be identified by the following properties:—1. A small quantity of the powder, placed on platinum foil, is entirely volatilized at a moderate heat (370°) in a white vapour. Should there be any residue, it is impurity; sometimes plaster of Paris or chalk is found mixed with it. If a small portion of the white powder be very slowly heated in a glass tube of narrow bore, it will be sublimed without melting, and form a ring of minute octahedral crystals, remarkable for their lustre and brilliancy. Under a microscope of high magnifying power (250 diameters), the appearance of these crystals is remarkably beautiful and characteristic: one not exceeding the 4,000th of an inch in diameter may be easily recognized by the aid of this instrument. They may be measured even to the 16,000th of an inch in diameter. (See illustrations, pp. 202, 203.) It will be observed in these experiments that white arsenic in vapour possesses no odour. 2. On boiling a small quantity of the powder in distilled water, it is not dissolved, but it partly floats in a sort of film, while a part becomes aggregated in small lumps at the bottom of the vessel. It requires long boiling, in order that it should become dissolved and equally diffused through water. 3. When the powder is treated with a weak solution of sulphide of ammonium in a watch glass, there is no change of colour, as there is with most metallic poisons: on heating the mixture, the white powder is dissolved; and on continuing the heat until the ammonia is expelled, a rich yellow or orange-red film is left (sulphide of arsenic), which is soluble in alkalies, and insoluble in hydrochloric acid. 4. Heated on platinum wire in a smokeless flame, the powder imparts to it a pale blue colour, while it is volatilized in white fumes.

Reduction Process.—When a small portion of the powder, *i. e.* from one-fourth to one-twentieth part of a grain, is heated with some reducing agent containing carbon, such as *soda flux* (obtained by incinerating acetate or tartrate of soda in a close vessel), in a glass tube about three inches long and from one-eighth to a quarter of an inch in diameter, it is decomposed: a ring of metallic arsenic of an iron-grey colour is sublimed and deposited in a cool part of the tube. Well dried ferrocyanide of potassium may be substituted in this experiment for soda flux (Davy). Two parts of soda flux may be used to one of arsenic, or equal parts of ferrocyanide of potassium and arsenious acid. After heating, a minute trace of arsenic remains in the flux which cannot be expelled by heat. During the reduction, there is a perceptible odour, resembling that of garlic, which is possessed by metallic arsenic only, while passing from a state of vapour to arsenious acid. This *odour* was at one time looked upon as peculiar to arsenic, but no reliance is now placed on it as a matter of medical evidence—it is a mere accessory result. In this experiment of reduction, there are frequently two rings deposited in the tube (fig. 2):—the upper and larger ring has a brown colour, and appears to be a mixture of finely

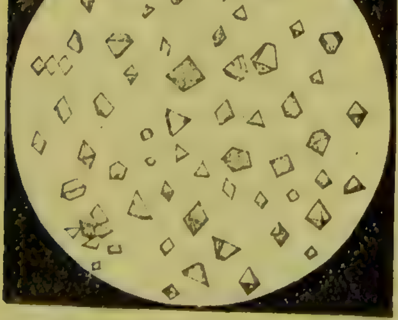


1. Berzelius's reduction tube, with sublimate of metallic arsenic.
2. Ordinary reduction tube, with two sublimates: the upper, brownish black; the lower, the pure metal in an annular deposit.
3. Small reduction tube, with a crystalline sublimate of arsenious acid.
4. The tube with sublimate magnified, showing the octahedral form of the crystals. These are shown still more highly magnified in the illustration at p. 203.

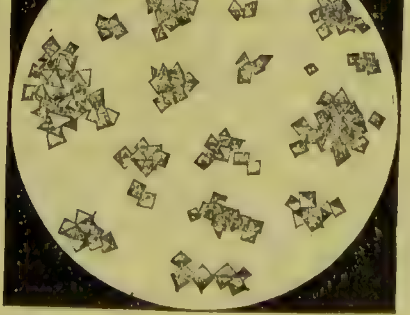
divided metallic arsenic and arsenious acid: the lower ring is small and consists of the pure metal. In order to determine the *weight of a sublimate*, the glass tube should be filed off closely on each side of the metallic ring, and weighed; the sublimate may then be driven off by heat, and the piece of glass again weighed:—the difference or loss represents the weight. These sublimates are remarkably light, and require to be weighed in a delicate balance. By heating gently the tube containing the sublimate (reduced to powder) in another tube of larger diameter, the metallic arsenic, during volatilization, forms octahedral crystals of arsenious acid, which, after examination by the microscope, may be dissolved in a few drops of water, and tested by one or more of the liquid reagents. The metallic sublimate, or the crystals produced from it, may be further subjected to the following process:—Break the glass on which the sublimate is deposited, into fragments, and digest these in a few drops of the strongest nitric acid, containing nitrous acid, previously proved to be free from arsenic. The sublimate is thereby converted into arsenic acid. The acid solution should be evaporated to dryness; the white uncrystalline residue obtained should be dissolved in a few drops of distilled water, and a strong solution of nitrate, or of ammonio-nitrate, of silver added in small quantity to the residue. A brick-red colouration indicates arsenic acid, and thus proves incontestably that the sublimate was of an arsenical nature.

The upper or brownish-looking sublimate (fig. 2), may be readily converted into one of the pure metal, by gently heating it in the flame of a spirit lamp. Arsenious acid is then volatilized, and an iron-grey deposit of metallic arsenic appears. If the heat is continued, the whole of the metallic sublimate is volatilized and deposited in a cool part of the tube, in transparent and colourless octahedra of arsenious acid. This is the special character of an arsenical sublimate: it may be thus distinguished from sublimates of all metals or metalloids. The lower metallic sublimate procured by reduction (fig. 2) may appear not in an annular form, but in particles of a somewhat globular shape. These are of an iron-grey colour, quite unlike sublimed mercury, and when examined by the microscope, it may be seen that they consist of crystalline masses nucleated, and that they are not strictly spherical. This sublimate is produced in the last stage, when the residue in the tube is strongly heated.

The *process of reduction*, with the corroborative results above mentioned, is, when thus applied, conclusive of the arsenical nature of the substance under examination.



Crystals of Arsenious Acid by sublimation, magnified 30 diameters.



Crystals of Arsenious Acid from a solution, magnified 124 diameters.

Arsenic in solution in Water. Liquid Tests.—The solution of arsenious acid is clear, colourless, possesses scarcely any perceptible taste, and has but a feebly acid reaction. In this state, we should first evaporate slowly a few drops on a glass slide, when a crystalline crust will be obtained. On examining this crust with a microscope, it will be found to consist of numerous minute octahedral crystals, presenting triangular surfaces by reflected light. (See illustration, p. 203.)

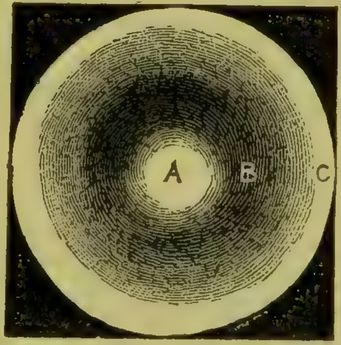
1. *Silver Test.*—On adding to the solution, *ammonio-nitrate of silver*, a pale yellow precipitate of arsenite of silver falls down;—changing, under exposure to daylight, to a greenish-brown colour. The test is made by adding to a strong solution of nitrate of silver, a weak solution of ammonia, and continuing to add the latter, until the brown oxide of silver, at first thrown down, is almost re-dissolved. The yellow precipitate is soluble in nitric, tartaric, citric, and acetic acids, as well as in ammonia. It is not dissolved by potash or soda.

2. *Copper Test.*—On adding to a solution of arsenic, *ammonio-sulphate of copper*, a light green precipitate (arsenite of copper) is formed, the tint of which varies according to the proportion of arsenic present, and the quantity of the test added: hence, if the arsenic is in small proportion, no green precipitate at first appears; the liquid simply acquires a blue colour from the test. In less than an hour, if arsenic is present, a bright green deposit is formed, which may be easily separated from the blue liquid by decantation. This test is made by adding ammonia to a weak solution of sulphate of copper, until the bluish-white precipitate, at first produced, is nearly re-dissolved: it should not be used in large quantity if concentrated, as the deep blue colour tends to obscure or conceal the green precipitate formed. The precipitated arsenite of copper is soluble in all acids, mineral and vegetable, and in ammonia, but not in potash or soda. If a small quantity of the blue ammoniacal solution of this precipitate is poured over a crystal of nitrate of silver, a film of yellow arsenite of silver will appear around the crystal, by the production of arsenite of silver. If a strong solution of nitrate is added to the blue liquid, nearly neutralised by diluted sulphuric acid, a yellow precipitate of arsenite of silver is also produced. Thus the silver and copper tests may be employed with one quantity of liquid. The *dried* precipitate of arsenite of copper, when slowly and moderately heated in a well-dried reduction-tube, yields a ring of octahedral crystals of arsenious acid,—oxide of copper being left as a residue.

3. *Sulphuretted Hydrogen Test.*—The sulphide of ammonium gives no precipitate in a solution of arsenic until an acid has been added, by which property, arsenic is known from most metallic poisons. On adding an acid (dilute hydrochloric free from arsenic), a rich golden yellow-coloured precipitate is thrown down (orpiment or sulphide of arsenic). It is better, however, to employ in medico-legal analysis, a current of washed sulphuretted hydrogen gas, which is easily procured by adding to sulphide of iron in a proper apparatus, a mixture of one part of strong sulphuric acid and three parts of water. The arsenical liquid should be slightly acidulated with pure diluted hydrochloric acid, *before* the gas is passed into it: at least, care should be taken that it is not alkaline. The yellow compound is immediately produced if arsenic is present, and it may be collected after boiling the liquid sufficiently to drive off any surplus gas. The precipitation is likewise facilitated by adding to the liquid a solution of hydrochlorate of ammonia. The yellow precipitate is known to be sulphide of *arsenic* by the following properties:—1. It is insoluble in water, alcohol, and ether, as well as in diluted hydrochloric acid, and vegetable acids: but it is decomposed by strong nitric and nitro-hydrochloric acids. 2. It is immediately dissolved by potash, soda, or ammonia; forming, if no organic matter is present, a colourless solution. 3. When dried and heated with three parts of soda-flux, or of dry ferrocyanide of potassium, it gives a sublimate of metallic arsenic. Unless these properties are proved to be possessed by the yellow precipitate formed by sulphuretted hydrogen in an

unknown liquid, it cannot be a compound of arsenic; and it would not be safe as a general rule to receive evidence on the point. On the other hand, when these properties are possessed by the precipitate, it must be arsenic, and can be no other substance.

Marsh's Process. Hydrogen Test.—The action of this test depends on the decomposition of arsenious acid and its soluble compounds, by hydrogen evolved from the action of diluted sulphuric or hydrochloric acid on zinc. The materials should be first proved to be free from arsenic. The apparatus is of the most simple kind, and is so well known as to need no description. The arsenic may be introduced into the short leg of the tube in the state of powder; but it is far better to dissolve it in water, by boiling, either with or without the addition of a few drops of potash. The metallic arsenic combines with the hydrogen, forming arsenuretted hydrogen gas, which possesses the following properties:—1. Filtering paper wetted with a solution of nitrate of silver is immediately blackened by the gas—the silver being reduced to the metallic state. Lead-paper is not changed in colour unless sulphuretted hydrogen is also present. 2. It burns with a pale bluish-white flame, and thick white smoke (arsenious acid). 3. A slip of glass or of white porcelain held in the flame near the point (for not too long a time) acquires a dark stain from the deposit of metallic arsenic upon it. This deposit presents a metallic lustre in the centre (A), a white film of arsenious acid on the outside (C), and between the two a dark ring of a pulverulent substance (B), which, when viewed by transmitted light, is hair-brown in colour towards the margin, but perfectly opaque in the centre. In order to determine the arsenical nature of the deposits, the following plan may be adopted:—Several of them should be received and accumulated in small porcelain capsules, held over the burning gas. To one, add a solution of chloride of lime: the arsenical deposit is immediately dissolved. To a second, add a solution of sulphide of ammonium: the metallic deposit is detached, but not perfectly dissolved: yet on evaporation it yields a pale yellow film of sulphide of arsenic. To a third, add a few drops of the strongest nitric containing some nitrous acid. The deposit is dissolved: evaporate the acid solution gently to dryness; carefully neutralize the residue, and add one or two drops of a strong solution of nitrate of silver. A brick red stain or a dark red precipitate of arsenate of silver will be produced.



Deposit obtained by Marsh's apparatus.
A. Metal.
B. Mixed deposit.
C. Arsenious acid.

Reinsch's Process.—In the application of this process, the liquid suspected to contain arsenic, or the solid dissolved in distilled water, is boiled with from one-sixth to one-eighth part of *pure* hydrochloric acid (proved to be free from arsenic), and a small slip of copper is then introduced. A slip of polished copper foil (electric copper) about a quarter of an inch square, attached to the end of a fine platinum wire, may be employed for the experiment. The copper must be first proved to be free from arsenic, as this is a very common contamination of commercial copper in the form of foil, gauze, or wire. If arsenic is present in the liquid, even in small quantity, the polished copper acquires either immediately or within a few minutes a dark iron-grey coating from the deposit of this metal. This is apt to scale off, if the arsenic is in large quantity, or if the liquid is very acid or long boiled. We remove the slip of copper, wash it in water, dry it, and gently heat it in a reduction-tube, when arsenious acid will be sublimed in minute octahedral crystals: if these should not be apparent from one piece of copper, several may be successively introduced. When the quantity of arsenic is very small, the polished copper merely acquires a faint violet or bluish tint. The deposit is in all cases materially affected by the quantity of water present, or, in other words, the degree of dilution, and sometimes it will appear only after the liquid has been much concentrated by evaporation. We are not obliged to dilute the liquid in the experiment, and there is no material loss of arsenic, as in the hydrogen process:—the whole may be removed and collected by the introduction of successive portions of pure copper. This process is extremely delicate, the results are speedily obtained, and are highly satisfactory. Among the cautions to be observed are these: 1. not to employ too large a surface of copper in the first instance; and 2. not to remove the copper from the liquid too soon. When the arsenic is in minute quantity, and the liquid much diluted, the deposit does not take place sometimes for half an hour. If the copper is kept in for an hour or longer, it may acquire a dingy tarnish from the action of the acid and air. There is one corroboration required. The steel-grey colour of the deposit is in itself characteristic of arsenic, but whether this is seen or not, the copper with the deposit upon it, should be well dried, cut into small pieces if necessary, and introduced into a *dry* and perfectly clean reduction-tube. The application of a gentle heat by a spirit lamp will cause the metallic arsenic to be volatilized as white arsenious acid, which is deposited in a cool part of the tube, in the form of octahedra or of the derivatives of the octahedron. When examined by a quarter of an inch power under the microscope, these crystals may be seen and recognized by their shape up to the sixteen-thousandth of an inch in width. The smaller the crystal the more perfect the form. (See fig. 4, p. 202.) If the copper with the deposit and the tube have not been well dried, the angularity of form is not distinct. These crystals may be tested by the processes described at p. 203.

The best method of testing copper for arsenic is, I believe, the following: Expose the copper to air in a saucer or vessel containing pure and strong hydrochloric acid. In a few days a dark brown liquid is procured (a mixture of subchloride of copper in the surplus acid). This acid liquid should be slowly distilled in a flask or retort by the aid of a sand-bath. (See Illustration, p. 208.) If arsenic is contained in the copper, it will be obtained as a clear, colourless chloride in the receiver with hydrochloric acid. The acid distillate, properly diluted, should now be placed with pure zinc in a flask, and the gas produced should be tested for arsenic by the various methods elsewhere described (p. 209). Mr. Abel has communicated to me a very simple method for testing the presence of arsenic in copper. Add to pure hydrochloric acid, diluted with six parts of water, one or two drops of a weak solution of persulphate or perchloride of iron. Boil the acid liquid and introduce the copper, well cleaned and polished, into the boiling liquid. Arsenicated copper soon acquires a dark tarnish, while the non-arsenicated (electric) copper retains its colour under these circumstances.

It is unnecessary in this place to enter into a comparison of the processes of Marsh and Reinsch, in respect to their relative powers of enabling the analyst to detect small quantities of arsenic. It may be conceded that Marsh's process will detect a smaller quantity of arsenic than the process of Reinsch, but the latter, when the quantity of liquid is small, will detect the 1-150th or the 1-200th part of a grain of the poison, and this is itself a point of delicacy in analysis which, when the issues of life and death are involved, might almost suffice to justify a reasonable distrust of the resources of science. It would require considerable courage to go beyond this, and it appears to me that in a criminal case, it would not be safe to depose to the presence of arsenic from Marsh's process alone, when the quantity of poison was *too small* to admit of separation or corroboration by the process of Reinsch. Conversely, the results of Reinsch's, should be corroborated by those of Marsh's process. When the point of detection by Reinsch's process has been passed, then we increase the chance of fallacy to which Marsh's process is always exposed, by the fact that such very minute traces of arsenic may have existed in some of the materials used, or in the apparatus employed. It was this over-reliance on the extreme delicacy of the process in researches where it admitted of no corroboration whatever, that led Orfila to assert that arsenic was a natural constituent of the human body!

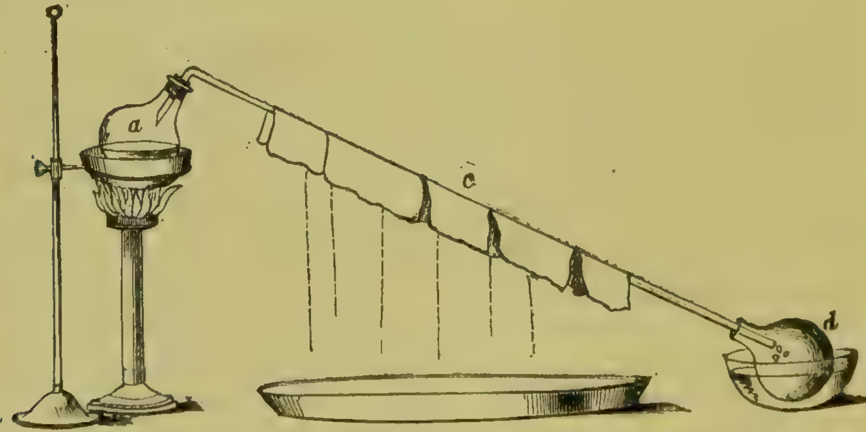
Arsenic in liquids containing Organic Matter.—The liquid for analysis should be strained through muslin, or filtered through paper in order to separate any insoluble matters: these should be well pressed and drained. Should the liquid be coloured, this is of little moment, provided it is clear. If viscid, it should be diluted with water, and boiled with a small quantity of hydrochloric acid; on standing, a deposit may take place, and this should be separated by a filter. Dialysis may be now resorted to, but this has the disadvantage of diffusing the arsenic with soluble organic matter through a very large quantity of water. As a trial test, we may boil in a portion of the liquid, acidulated with pure hydrochloric acid, a slip of pure copper highly polished, and test any deposits on the metal by the method above described.

Precipitation as sulphide.—When arsenic is present in an organic liquid in large quantity, it may be precipitated as sulphide by a current of washed sulphuretted hydrogen. The liquid should be boiled, filtered, and acidulated with hydrochloric acid before passing the gas into it. When precipitation has ceased, the liquid should be again filtered, the precipitate collected, dried and weighed. By operating on a measured portion of the solution, the amount of white arsenic present may be determined by the weight of the sulphide obtained —five parts by weight of sulphide being equal to four parts of white arsenic. The properties of the yellow precipitate should be verified according to the rules mentioned at page 204. In some cases arsenic may be present, but in a quantity too small to be precipitated as sulphide by sulphuretted hydrogen. In others the presence of certain substances may interfere with or prevent precipitation. The presence of any alkali in a liquid prevents the formation of a precipitate. (Chemical News, Dec. 12, 1863.)

The contents of the stomach or any liquid article of food may contain arsenic in an insoluble form—*i.e.* as a crystalline powder. This may be separated as a heavy sediment, by careful washing with distilled water, and then tested by the reduction-process (p. 202).

When arsenic is thus found in powder, as a sediment in organic liquids, it is obvious that it must have been taken in the solid state, and, although mixed with a liquid or solid, still in an undissolved form. Arsenic, administered in a state of solution, could not become solid in the stomach except as a result of perfect desiccation of the tissues. If found only dissolved, it may have been taken either in solution or in a solid form—the dissolved portion being part of the solid taken up by the fluids of the stomach, and the remainder having been expelled by vomiting and purging. This question was of importance in *Reg.* v. *Sturt*, Lewes Lent Assizes, 1863. The deceased, in this case, died from the effects of arsenic in powder, administered, it was believed, in a mince-pie. It was suggested that the poison might have been swallowed in ginger-beer, but then it could not have been in a state of solution: it must have been mechanically mixed with the liquid. The learned Judge who tried this case, was obviously not aware of any difference existing between the actual solution and the mechanical suspension of a solid in a liquid.

Distillation Process.—When the poison is in so small a quantity that it does not admit of precipitation by sulphuretted hydrogen, and no solid particles of arsenic are found in the stomach, in its contents, or in any article of food, another method may be resorted to for detecting its presence. This method equally applies to the detection of arsenic deposited as a result of absorption in the soft organs of the body, as in the liver, kidney, or heart, and to arsenic in all its forms, except the pure insoluble sulphide or orpiment. Although, after long interment, white arsenic passes, more or less rapidly, into the state of yellow sulphide as a result of chemical changes during putrefaction, the conversion is generally only partial or superficial. I have never found it to be so complete as to prevent the detection of the poison by the distillation process. The only condition for success is, that the substance, whether food, blood, mucus, the liver, or other organ, should be first thoroughly dried either by exposure to a current of air or by a water-bath. The dried solid should then be broken into small portions and placed in a flask or retort of sufficient capacity, with a quantity of the strongest hydrochloric acid to drench it completely. The freedom of this acid from arsenic, should be first carefully determined. The complete separation of arsenic from organic substances depends greatly on their perfect desiccation, and on the concentration of the acid employed. After some hours' digestion the retort or flask (*a*) containing the mixture—which should be of such a size that the materials should not fill it to more than one-third or one-half of its capacity—should be fitted with a long condensing tube (*c*), and then gradually heated by a sand-bath until the acid liquid begins to pass over. A metallic head, formed of a cone of tin plate, should be placed over the retort or flask so as to concentrate the heat and prevent condensation in the upper part of the vessel. A small flask receiver (*d*) with a loosely-fitting cork may be employed to collect the product. This should contain a small quantity of distilled water so as to fix and condense any vapours that may pass over. The receiver, as well as the condensing-tube, should be kept cool by wetting its surface with cold water diffused on a layer of bibulous paper placed over it. The perfect condensation of the distilled liquid is ensured by this arrangement. The distillation may be carried to dryness on a sand-bath, or nearly so; and it may be sometimes advisable, in order to ensure the separation of the whole of the arsenic as chloride, to add to the residue in the retort, another portion of pure and concentrated hydrochloric acid, and again distil to dryness. I have, however, found that portions of dried liver and stomach gave up every trace of arsenic by one distillation, when a sufficient quantity of hydrochloric acid had been used, and the process slowly conducted by a regulated sand-bath heat.



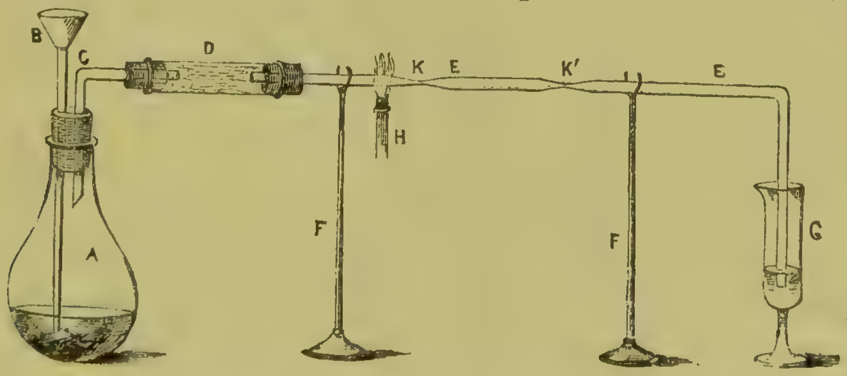
Apparatus for distilling organic and mineral substances containing Arsenic.

The liquid product is sometimes coloured, and highly offensive if distilled from decomposed animal matter. It may also be turbid. Exposure to the air for a few hours sometimes removes the offensiveness, and there is a precipitation of sulphur, or of some sulphide of arsenic. The distillate may be separated from any deposit by filtration, and if still turbid, it may be again distilled at a lower heat to separate it from any organic matter that may have come over.

If arsenic was present in the solid, the distillate will contain chloride of arsenic, which does not escape from a diluted solution at common temperatures. The quantity of dry organic substance used in the experiment must depend on the quantity of arsenic present, as revealed by a preliminary trial with Reinsch's process. If large, two or three drachms of the dried substance, or even less, will yield sufficient chloride of arsenic for further proceedings. For the absorbed and deposited poison, half an ounce of the dried organ, corresponding to two ounces of the soft organ, will frequently suffice; but a negative conclusion of the absence of arsenic should not be drawn from a smaller quantity than two to four ounces of the dried substance, whether liver, kidney, or heart. These tissues, it must be remembered, contain about 76 per cent. of water. If oily matter should be distilled over, this may be separated by passing the distillate through a paper filter wetted with water.

I have found this process efficient for procuring a clear solution of chloride of arsenic from such different substances as starch—a cake—ordinary food—the liver and other soft organs—the scalp of the head—blood—contents of the stomach—arsenical wall-papers—metallic copper—blue vitriol—and various mineral powders. I have thus discovered arsenic in two ounces of the earth of a cemetery at Boston, and in a like quantity of earth from the cemetery of Kirkby Lonsdale, as well as in Thames mud, in spite of the presence of much oxide of iron and earthy matter. Wherever the arsenic admits of solution in hydrochloric acid, however small the quantity present, it may be readily obtained as chloride. This distillation-process has the advantage of not interfering with the research for mercury, lead, copper, and other poisonous metals which do not form volatile chlorides. Arsenic is thus separated from them, and these metals may be found in the residue contained in the flask or retort. Even antimony, which forms a volatile chloride, is not so readily distilled over as arsenic.

The distilled liquid may either be preserved for examination, or it may be at once submitted to a further stage of analysis. For this purpose one third of it should be diluted with three or four parts of water and boiled in a clean flask. When boiling, a piece of bright copper-foil (free from arsenic), of about the size of the sixteenth of a square inch, should be introduced. If there is chloride of arsenic in the liquid, even up to the 1-4000th of a grain, its resence will be indicated by a change of colour, and by the deposit of a dark etallic film on the copper. If the liquid should be too much diluted for this urpose, it may be concentrated on the polished copper, and the deposit will ter a time be apparent. If the quantity of arsenic present is believed to be ery small, the surface of copper introduced should be proportionately small.

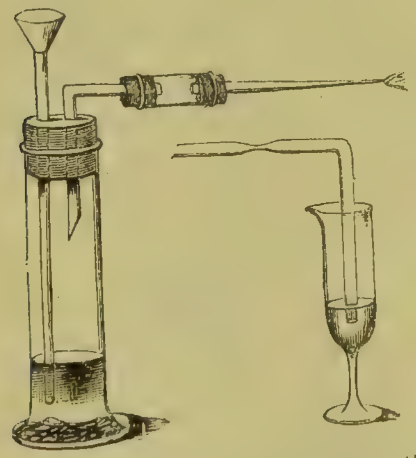


Apparatus for testing chloride of arsenic obtained by distillation.

Portion of tube separated with a deposit of metallic arsenic in the contracted portion.

The remaining two-thirds of the distilled liquid, sufficiently diluted, should now be introduced into a Marsh's tube, or into an evolution flask provided with a funnel tube, the capacity of which must be regulated by the quantity of acid liquid to be examined. The kind of apparatus employed in this stage is represented in the annexed engraving. A the flask, with funnel tube B, and connecting piece C; the funnel tube should be long enough just to dip below the surface of the acid liquid. The short connecting piece is bent at a right angle, and, like B, is carried through a closely fitting cork in the neck of the flask. This tube should be only long enough to go through the cork, and its open end should be bevelled off to a fine point, so that any vapour which is condensed on it may fall back as liquid into the flask. D is the drying tube containing fragments of chloride of calcium, secured by cotton at both ends. At the flask end of this tube should be placed some well-dried bibulous paper, saturated with acetate of lead. This has the advantage of stopping any gaseous sulphur compound, which may escape from the zinc or acid liquid. E E, a hard and not easily fusible glass tube, free from lead, contracted in two situations K K′, to about the diameter of the tenth of an inch or less, the tube itself having a diameter of from a quarter to three-eighths of an inch. F F are supports made of stout wire, to prevent the tube from falling when heated to redness. G is a test glass to hold one or two drachms of a strong solution of nitrate of silver. H is a Bunsen's air-gas jet, which gives a stronger heat than a spirit-lamp, although the latter may be used.

The arrangement being thus made, the zinc and hydrochloric acid are first tested as to their freedom from arsenic. Portions of pure zinc are placed in the flask A, the parts of the apparatus are then connected, and pure hydrochloric acid, diluted with three or four parts of water, is poured into the flask by the funnel B, which operates as a safety valve. Bubbles of air and gas speedily appear in the liquid in G, if the corks fit well, and the whole of the arrangements are air-tight. Pure zinc is sometimes but imperfectly acted on by the acid. In this case some clean platinum wire may be wound round the bars of the zinc, and the evolution of hydrogen will be thus accelerated. It is, however, better that the hydrogen should come off rather slowly. If the materials are pure, the solution of nitrate of silver should undergo no change of colour. The glass G should be placed on a sheet of white paper, whereby the slightest tinge of brown or black is made perceptible. When all the air is expelled from the tube, the flame H may be applied to it at about one inch in front of a contraction of the glass, as indicated in the engraving, and the glass heated to redness. No metallic deposit should take place at K. If the materials are quite pure, the transparency of the glass tube at K will be unchanged. From a quarter to half an hour will be sufficient for this experiment.



Tube apparatus for testing a small quantity of liquid containing chloride of arsenic.

In order to guard against any possible source of error from the adventitious production of solid hydride of arsenic by the reaction of the acid on the zinc, M. Blondlot advises that a small quantity of a solution of sugar, known to be free from arsenic, should be introduced into the flask, by means of the funnel tube B. This, in the presence of an acid, will, according to him, decompose any solid hydride that may have been produced from impurity in the materials, and set free arseniuretted hydrogen. If, after this addition, the silver solution remains unchanged in colour, the materials may be regarded as pure. A portion or the whole of the distillate is now added to the acid liquid in the flask by means of the funnel tube. The first indication of the presence of arsenic is manifested by the silver solution becoming gradually brown, and finally black, a dense precipitate of metallic silver resulting from the chemical changes. If it should become very suddenly black and flaky, the presence of sulphur may be suspected. This will be further indicated by a change of colour in the lead paper in D. Pure arsenuretted hydrogen does not alter the colour of this paper. When the silver solution is nearly blackened, the flame may be applied as indicated in the drawing, and kept steadily at this point. At a red heat, visible in daylight (1200°), arsenuretted hydrogen is decomposed, and metallic arsenic is deposited; but being a volatile metal it is carried onward by the hot current of gas, and forms at first a brown and then a black metallic mirror at K, *i. e.* in the contracted part of the tube which is cool. When a sufficiently thick deposit is obtained, the flame may be applied to the tube about an inch in front of K′. Thus as many deposits of metallic arsenic may be procured, as there are contractions in the glass tube.

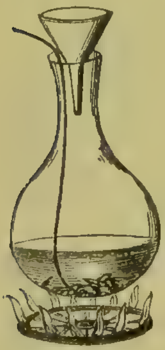
The silver solution is allowed to become saturated with the gas. Any escape of the gas from the glass, or by leakage from any of the junctions of the apparatus, is at once indicated by holding near to the spot, filtering paper wetted with nitrate of silver. This is instantly blackened. The glass with the silver solution is removed, the end of the tube well washed, or another tube substituted for E E, and this is allowed to dip into about one drachm of the strongest nitric acid, containing much nitrous acid in a test-glass similar to G, or into a small porcelain capsule. After a time, the acid loses its colour, and the metallic arsenic of the gas is converted into arsenic acid, which may be obtained by evaporation.

The further testing of the products is a very simple process. 1. The silver solution contains arsenic in the state of arsenious acid dissolved, with some excess of nitrate of silver. By one or two filtrations it is obtained colourless and clear. A weak solution of ammonia is then added to it, and yellow arsenite of silver is at once precipitated (see p. 203). 2. The nitric acid liquid is evaporated to dryness in a small porcelain capsule. One or two drops of water are added to the residue, with a drop of weak ammonia if it should be very acid. A strong solution of nitrate of silver is then added to it: arsenate of silver, of its well-known brick-red colour, is immediately produced. 3. The portions of tube K K′ with the metallic deposits in them may be separated by a file, and then hermetically sealed, or, if necessary, one or more of them may be tested by the methods described in a preceding page (see 202).

With these results the evidence of the presence of arsenic may be considered as conclusive. The poison is obtained by this process, not only in its pure metallic state, but in the distinct forms of its two well-known oxides—arsenious and arsenic acid. Any demonstration beyond this is superfluous. It will be observed that Reinsch's process is here employed as an adjunct to Marsh's process in an improved form in which the burning of the gas is unnecessary. The arsenic by distillation is first converted into chloride, the chloride into hydride, and the hydride into the respective oxides. In the different stages of this operation, all other metals, excepting antimony, are entirely excluded, and this, under the circumstances, may be easily distinguished from arsenic (see Antimony). The zinc which has been used for one experiment is not fitted for use in a second. M. Blondlot has discovered that in the usual method of operating on distilled zinc with hydrochloric or sulphuric acid, only moderately diluted, a blackish-brown flaky compound is formed which detaches itself from the zinc and floats in the acid liquid. He finds this to be arsenic in the form of a solid and insoluble hydride. Concentrated or diluted acids do not act upon it in the cold, but at a boiling temperature these acids decompose it. Nitric acid and chlorine rapidly dissolve it in the cold. Heated in a dry tube it is resolved into arsenious acid and water. Nascent hydrogen has no action upon it unless organic matter is present, when it is instantly converted into arsenuretted hydrogen. It commonly attaches itself to the zinc employed in the experiment: by exposure to air it is gradually transformed into arsenious acid; and thus a bar of zinc which does not show the presence of arsenic on its withdrawal from the acid, may become coated with oxidized arsenic, as a result of exposure, so as to lead to a serious fallacy if used in another experiment. From the investigations of MM. Blondlot and Gaultier de Claubry, it appears that in the old carbonizing processes by sulphuric, nitric, first a brown and then a black metallic mirror at K, *i.e.* in the contracted part and hydrochloric acids, the arsenic, when in small quantity, was always liable hydride. ('Annales d'Hygiène,' 1864, 1, p. 159.) The distillation-process which renders carbonization of the organs unnecessary, gets rid of this difficulty.

Dr. Schneider of Vienna was the first to suggest in 1851-2, a method of extracting arsenic from organic matter as a volatile chloride. For this purpose he employed sulphuric acid and common salt. His process is well-known on the Continent under the name of Schneider's process. It was described in the 5th edition of my 'Manual of Medical Jurisprudence,' 1854, p. 80. It has the disadvantage of introducing much mineral matter into the substance distilled,—as well as of producing a large amount of froth, and thus embarrassing the operation. The modification of it above described, in which pure hydrochloric acid alone is required, will be found more convenient in practice.

Reinsch's Process alone may be employed for detecting arsenic, deposited as a result of absorption, in the liver, kidneys, or other organs. About four ounces of the recent organ, or more, if necessary, cut into small pieces, may be boiled in a flask in a mixture of one part of pure hydrochloric acid and four of water, until the structure of the organ is broken up. The flask may be of the shape represented in the annexed engraving, and either a naked spirit-flame or a sand-bath may be employed. A small glass funnel should be placed in the neck of the flask. This receives and condenses the vapour which falls back into the flask. By this arrangement the boiling may be continued for a long time, without material loss by evaporation. The flask should not be more than half full, and heated gently until all froth is expelled. A slip of fine platinum wire, having a small piece of pure copper-foil, should be immersed in the liquid when boiling. This enables the operator to remove the copper and examine it at intervals, after immersing it in distilled water. If it is much coated with a metallic deposit, larger portions of copper-foil may be successively introduced until the liquid is exhausted. The deposits on the copper may then be tested by the methods described at page 206.



Flask employed in the analysis of substances by Reinsch's process.

It might be supposed that arsenic would escape as chloride in this method of operating, but when hydrochloric acid is diluted with six or eight parts of water, little or no volatile chloride is distilled over. In reference to the recent organs, a larger proportion of acid may be used, because three-fourths of the weight of the animal substance really consist of water.

I have not here described the various carbonizing processes which have been recommended by Orfila and other French medical jurists for the purpose of destroying organic matter. If M. Blondlot's observations are correct, they have been the source of great and unsuspected errors in medico-legal analyses — sometimes withdrawing the poison altogether, and sometimes causing it to reappear under circumstances which were liable to create a fallacy. ('Annales d'Hygiène,' 1864, 1, 152.)

It is important, in reference to the presence of absorbed arsenic in the *tissues*, to observe that it may be found at an early period, when it is either absent or only doubtfully present in other parts. In a case referred to me by Mr. Gell, coroner for Sussex, in May 1854, the deceased, *Burton*, died within *four hours* after he had been attacked with symptoms of poisoning by arsenic. Arsenic was found in small quantity in the stomach, duodenum, and rectum. It was also detected in the liver and spleen; and the proportion found was greater in the latter than in the former organ. In November 1861, a man died from the effects of arsenic in the most acute form, soon after his admission into Guy's Hospital. He had swallowed unknowingly a large dose of the poison in water. His wife left him at 1·30 P. M. quite well: during her absence he swallowed the poison, and on her return at 4, she found him very ill, and suffering from vomiting and purging. He was brought to the hospital, and died soon afterwards. Barely *three hours* could have elapsed from the time at which the poison was taken until his death. There were the usual appearances in the stomach, intense inflammation, especially at the pyloric end; and gritty portions of arsenic mixed with masses of coagulated mucus, and false membranes were found in the contents. The intestines were inflamed, and portions of arsenic were discovered as low as the cæcum. Arsenic was found abundantly in the stomach, and a comparatively large quantity of the poison was detected in half an ounce of the dried liver, as well as in the spleen and kidney. Hence it is obvious that the poison may be rapidly absorbed and copiously deposited within *three* hours, the quantity thus found depending apparently on the dose taken. In the cases of the *Atlee* family, referred to me by Mr. Carter, coroner for Surrey, in January 1854, the body of the mother was exhumed after a month. Arsenic was *not* found in the *stomach* or *bowels*, but it was readily detected in a small portion of the *liver*. The poison had probably been taken several days before death. The fact is of considerable importance in relation to a medical opinion of the presence or absence of poison in a dead body. It is commonly the practice to confine an analysis to the stomach and bowels only; and when no poison is found therein, o report that no poison exists in the body, and to refer death to natural causes. t is clear, however, from the above case, that such an opinion might be eroneous unless the liver or spleen had undergone a chemical examination. In eserving viscera for analysis, a portion of the liver should therefore always e examined. If the person has lived fifteen or sixteen days after having aken the poison, no trace may be found in the tissues or in any part of the ody. Orfila long since expressed this opinion from his experiments on nimals; its correctness has been strikingly confirmed by the case of Dr. *lexander*, who died in sixteen days from a large dose of arsenic taken by istake in arrowroot. Dr. Geoghegan, who was deputed to make an analysis f the stomach and other viscera, found no trace of the poison, either absorbed r unabsorbed, in any part of the body which he examined. (See 'Med. Times and Gazette,' April 18, 1857, p. 389.) It is the more necessary that e fact of entire elimination should be remembered, because it has been inorrectly impressed on the public mind that no person can die from poison, xcept the poison be found by chemical analysis in the body after death. At e trial of *William Palmer*, and on other public occasions, men of repute as xicologists have greatly added to the difficulties of medical evidence, and ave embarrassed medical witnesses, by affirming that if death had really taken lace from poison, it should always be found. If this is untrue with respect to arsenic, it is necessarily untrue with regard to poisons less easy of detection in minute quantities.

In the case of the *Queen* v. *Williams* (South Wales Circuit, July 1863), Mr. Herapath, of Bristol, confirmed by his evidence the observations of Dr. Geoghegan. A woman was charged with the murder of her husband by administering to him arsenic. The evidence left no doubt that deceased had suffered from the usual symptoms of poisoning, namely, inflammation of the stomach and bowels, numbness of the limbs, and other symptoms. For some days before the deceased's death, owing to his food having been prepared for him by his daughter, the symptoms abated; but he ultimately died from exhaustion. Mr. Herapath examined the viscera, and found no arsenic. Neither in his reading nor in his experience had he known arsenic to have been detected fifteen days after its administration. As no poison was discovered in the body, the prisoner was acquitted of the charge of murder, but found guilty of the intent. ('Lancet,' July 11, 1863, p. 47.) In the case of *Soufflard*, a large dose of arsenic had been taken; but according to M. Legroux, no trace of the poison existed in the stomach or in the ulcerated portions of the bowels. ('Union Médicale,' June 30, 1850.) When arsenic is discovered in the stomach mixed with food, it does not necessarily follow that it has been administered in that particular article of food. Should the person have partaken of food such as milk or gruel, subsequently to the swallowing of arsenic, these fluids will necessarily acquire an arsenical impregnation from the poison already contained in the stomach. The patients may have taken the arsenic in one kind of food, when another and an innocent description of food might thus inadvertently be pronounced to have been the vehicle. (See on this point the case of *Ann Merritt*, 'London Med. Gaz.,' Aug. 16, 1850, vol. 46, p. 291.)

It need hardly be observed that the *quantity of arsenic found in the stomach* or other organs can convey no accurate idea of the quantity actually taken by the deceased, since more or less of the poison may have been removed by violent vomiting and purging as well as by absorption and elimination. A large quantity found in the stomach or bowels indicates a large dose; but the finding of a small quantity does not prove that the dose was small. Notwithstanding these very obvious causes for the removal of a poison from the body, there is a strong prejudice among lawyers that the chemical evidence is defective unless the quantity found is sufficient to cause death. It would be just as reasonable, in a case in which a man has been killed by a discharge of small shot, to insist upon a failure of proof of the cause of death, because only a single pellet has been found in the body. The value of chemical evidence does not depend on the discovery of any particular *quantity* of poison in the stomach,—it is merely necessary that the evidence of its presence should be clear, distinct, conclusive, and satisfactory. At the same time, a reasonable objection may be taken to a dogmatic reliance upon the alleged discovery in a dead body, of minute fractional portions of a grain; and, considering the great liability to fallacy from the accidental presence of arsenic in the articles used, the chemical evidence in the French case of *Madame Laffarge* (1840), in which the whole quantity discovered in the dead body was stated to be the hundred and thirtieth part of a grain, was of a most unsatisfactory kind, and should have been rejected by the Court. No man with any respect for his character, or for the common sense of a jury, would base chemical evidence on the thousandth, or less than the thousandth, part of a grain of poison in a case of life and death: although, for the purpose of procuring the acquittal of a criminal, he might make use of his alleged power to detect this, or even a smaller quantity.

It has been supposed that the *quantity* of arsenic found in the stomach and bowels may throw a light on the question, whether the poison had been taken voluntarily with the intention of committing suicide, or whether it had been criminally administered by another; *i. e.* supposing the evidence to establish that there could have been only one act of administration. There is no doubt that a much larger dose may be taken by a suicide than could be secretly administered by a murderer; and thus, if a large quantity is found in the stomach, it is supposed to furnish a presumption in favour of suicide and against murder. Suicides have been known to take as much as two table-spoonfuls, or *one thousand grains*, of arsenic. How much may remain in a dead body must, however, depend on the amount of vomiting and purging, and the length of time the person survives. In one case of murder by poison I found in the stomach, on the exhumation of a body, eighteen months after death, twenty grains of arsenic. In the case of *L'Angelier* (*Reg.* v. *Madeline Smith*, Ed. High Court of Justiciary, June and July, 1857), Dr. Penny stated in evidence that the quantity of arsenic which he found in the stomach and contents of the deceased amounted to eighty-eight grains, and that some part of this was in hard, gritty, colourless, crystalline particles. As there was arsenic in the contents of the intestines, and there had been vomiting and purging, it is obvious that the deceased must have taken a very large dose of the poison; and it was one of the suggested difficulties of this case, to determine how the deceased could have taken the poison is so large a quantity unknowingly. The quantity found, however, amounted to no more than half a teaspoonful; and admitting that one half of the dose taken had been ejected, the question resolves itself into this: whether a teaspoonful of arsenic might not have been homicidally administered in chocolate, gruel, or some liquid, or in a state of admixture with solid food (cake). Although it is unusual to find half a teaspoonful of arsenic remaining in the stomach in a case of homicidal administration, it appears to me impossible to admit that this fact is inconsistent with an act of murder. A man half intoxicated might be thus poisoned; and if death took place in a few hours, even a larger quantity than that which was here found might remain in the stomach. Dr. Christison has now set this question at rest by the publication of a case in which a man was homicidally destroyed by arsenic, and the quantity found in the stomach after death was from ninety to one hundred grains. The man had survived from five to seven hours, and there had been frequent vomiting of a yellowish or greenish coloured liquid during this period. The arsenic was administered in whiskey-punch with sugar, and it was kept in suspension by constant stirring. ('Ed. Monthly Med. Journal,' December, 1857, p. 481.) In *Regina* v. *Dodds*, tried at the Lincoln Assizes in December, 1860, the prisoner was charged with administering arsenic to deceased with intent to murder. The quantity stated to have been found in the stomach by the medical witnesses was one hundred and fifty grains. There was no reason to suppose that he had taken the poison with suicidal intention; but, on the contrary, there was strong evidence to presume that it had been administered to him with a design to destroy life. I am indebted to Mr. Justice Willes for a note on a similar case. A woman named *Alice Hewitt* was tried before him (*Reg.* v. *Hewitt or Holt*) at the Chester Winter Assizes, 1863, and convicted of poisoning her mother with arsenic in the month of March preceding. Although the symptoms of irritant poisoning were very clearly marked, a medical man who attended her certified the cause of death as gastro-enteritis. Eleven weeks after the burial of the deceased, the body was exhumed and examined. It was proved that shortly before her mother's death, the prisoner had purchased a quarter of a pound of arsenic for threepence, and there was clear evidence of administration,—a large dose having been given to the deceased in liquid shortly before her death. The inspection revealed the extraordinary fact that 154 grains of solid arsenic were found in the stomach alone. It had been partially converted into sulphide as a result of putrefactive changes, and it was observed that the liver, omentum, and right side of the heart were thickly painted with yellow sulphide of arsenic. In reference to this colouration, I have in one instance seen the front of the spinal column behind the stomach tinged of a deep yellow from arsenic which had escaped through the coats of this organ. If a person has died with arsenic in the body, there is scarcely any limit to the period at which it may be detected. In the cases of two children examined by Mr. Herapath, in July 1849, the poison was discovered in the remains of the dead bodies after eight years' interment; in another case by Dr. Glover after twelve years ('Lancet,' July 9, 1853, p. 41); and in a remarkable instance which occurred to Dr. Webster, of Boston, it was discovered in the remains of a body, after fourteen years' burial in a tomb. It has been sought for, and not found, at much shorter periods after death when there was a very strong suspicion that the poison had been taken: but it is highly probable that in these cases there was little or no arsenic in the bodies at the time of death. The longer a person has survived after taking this poison, the less probable is it, *cæteris paribus*, that arsenic will be found in the remains. With respect to its detection in the stomach and bowels, if the vomiting and purging have been violent and the person has survived some days, none may be found. It is singular, however, to notice with what tenacity the mineral occasionally adheres to the mucous membrane in spite of vomiting and purging. In the case of the *Duke of Praslin*, who died in six days from a large dose of arsenic, some portion was still found in the intestines ('Ann. d'Hygiène,' 1847, p. 402); and in a case which was the subject of a criminal trial at the Leicester Autumn Assizes in 1860 (*Regina* v. *Holmes*), Mr. Lankester informed me that arsenic was detected in the intestines, although the deceased had survived the effects of a large dose for seven days, and had suffered from the usual symptoms.

The condition of the arsenic found in a dead stomach should be specially noticed. A witness should be prepared to say whether it is in fine powder or coarse fragments; whether it is mixed with soot or indigo, or whether it is in the ordinary state of white arsenic. These points may be material as evidence in reference to proof of possession, of purchase, or administration.

Arsenic is *not* a normal constituent of the body. Under no circumstances is it found in the tissues after death, except in cases in which it has been taken by or administered to the deceased.

Arsenite of Potash. Liquor Arsenicalis. (Fowler's Solution.)

Symptoms and Appearances.—There is, so far as I know, only one case recorded in which this solution has destroyed life. A woman took half an ounce (= two grains of arsenic) in divided doses, during a period of five days, and died from the effects. There was no vomiting or purging, but after death the stomach and intestines were found inflamed. ('Provincial Journal,' June 28, 1848, p. 347.)

A mixture of arsenic, soft soap, and tar-water is largely used in agricultural districts for killing the fly in sheep. This has caused death, under the usual symptoms of arsenical poisoning, in at least two instances. There is no doubt that a mixture of this kind is injurious to sheep unless very carefully used. In *Black* v. *Elliott* (Newcastle Assizes, Feb., 1859), damages were claimed for the loss of 850 sheep, said to have been poisoned by dipping them in an arsenical mixture of this description. The jury found a verdict for the plaintiff, with 1,400*l.* damages.

Analysis.—This solution has the odour of tincture of lavender, is of a reddish colour, and has an alkaline reaction. One fluid ounce of it contains four grains of arsenious acid. It gives at once a green precipitate (arsenite of copper) with the sulphate of copper, and a yellow precipitate with nitrate of silver. Acidulated with hydrochloric acid, and treated with a current of sulphuretted hydrogen gas, it yields a yellow sulphide; and when boiled with this acid and copper, a deposit is obtained which readily furnishes octahedral crystals of arsenious acid.

The *Arsenite of Soda* is as poisonous as the arsenite of potash. In December, 1857, three hundred and forty children belonging to an Industrial school near London were poisoned by this compound. It had been incautiously used for cleansing a steam-boiler, and had thus become mixed with the hot water which was drawn for the breakfasts of the children. The dose of arsenic taken by each child I found to be about one grain. All recovered, although some suffered severely. (See 'On Poisons,' 2nd ed. p. 378.) In the winter of 1863 a man died under the symptoms of acute poisoning by arsenic, owing to his having drunk beer out of a pot which had contained this *patent* cleansing liquid!

Fly-Water is a name applied to solutions of various arsenical compounds in water. Mixtures of this kind are formed by dissolving one part of the arsenite of soda or potash and two parts of sugar in twenty parts of water. Paper soaked in this solution, and dried, is used for poisoning flies; and perhaps this is the safest form in which arsenic can be used for such a purpose. A case of poisoning by fly-water, in which two grains and a half of arsenious acid destroyed the life of an adult in thirty-six hours, will be found reported in the 'Medical Gazette' (vol. 39, p. 116). Fly-powder is a dark coloured mixture of metallic arsenic and arsenious acid. The latter gives to it poisonous properties.

Arsenite of Copper. Scheele's Green. Emerald Green.

This is the only metallic arsenite which is met with in commerce and the arts, and it constitutes, wholly or in part, a great variety of green pigments, known as Emerald green (aceto-arsenite of copper) employed for paper-hangings, mineral green, Brunswick, Schweinfurt, or Vienna green. It is thus found in the form of oil-paint in cakes, in boxes of water colours, spread over confectionery, in wafers, in adhesive envelopes, and lastly and most abundantly, in various kinds of green decorative papers used for covering the walls of sitting and bedrooms.

Symptoms and Effects.—Although the arsenite of copper is insoluble in water, it is sufficiently soluble in the acid mucous fluids of the stomach to be taken up by the absorbents, and carried as a poison into the blood. A boy, aged three years, swallowed a small capsule of Scheele's green, used by his father as a pigment. In half an hour he complained of violent colic: there was frequent vomiting, with purging, cold sweats, intense thirst, and retraction of the parietes of the abdomen. The mouth and throat were stained of a deep green colour. Hydrated sesquioxide of iron was given: in about an hour the vomiting ceased, and soon afterwards the thirst and pain in the abdomen abated. The next morning the child was well. In another case a child, a year old, ate several pieces of a cake of arsenite of copper used for colours. There was immediate vomiting of a liquid containing green-coloured particles of the arsenite, but there were no other urgent symptoms. White of egg, with sugared water, was given to it. After a short time the child became pale and complained of pain in the abdomen: the pulse was frequent, the skin cold, and there was great depression. Copious purging followed, soon after which the child recovered. (Galtier, vol. 1, p. 636.) In the cases of two children poisoned by confectionery coloured with this substance, the chief symptom was incessant vomiting of a light green-coloured liquid, resembling bile diluted with water. Mr. Bully, of Reading, who reports these cases ('Medical Times,' April 28, 1849, page 507), describes the symptoms as severe, although the quantity of poison swallowed was small. Under the use of an emetic of ipecacuanha, the children recovered. Dr. Rose met with a case similar in its details. ('Lancet,' March 5, 1859, p. 237.) (See also 'Guy's Hosp. Reports,' Oct., 1850, p. 218; 'Medical Gazette,' vol. 43, p. 304; 'Edinburgh Monthly Journal,' July, 1851, p. 1; and 'Lancet,' March 5, 1859, p. 237.) In two cases which I examined in January, 1853, a small quantity of a confectionery ornament, coloured with arsenite of copper, proved fatal to two children. The symptoms and appearances were those of poisoning by arsenious acid. The quantity taken could not have been above two or three grains. The children picked up the ornament in the street and shared it between them. The poison was spread over a layer of sugar!

In a case which was the subject of a criminal trial, this substance was proved to have caused the death of a gentleman by reason of its having been employed to give a rich green colour to some blanc-mange served at a public dinner:—the person who employed it considering that emerald or mineral green was nothing more than an extract of spinach! It led to death under the usual symptoms, and the parties were convicted of manslaughter and sentenced to imprisonment. (*Reg.* v. *Franklin and Randall*, Northampton Summer Assizes, 1848.) Most of the colours used for confectionery are of a poisonous nature: the pink colour given by cochineal or madder is the only one which can be regarded as innocent.

Among other uses of this noxious compound, we find it employed for imparting a bright green colour to the shelves of bakers' and green-grocers' shops. An incident which occurred to myself will show that food may thus acquire an arsenical impregnation. Several loaves of bread were supplied to me, having upon the undercrust a quantity of green-coloured pigment, which on analysis turned out to be arsenite of copper, containing about fifty per cent. of arsenic! On inquiry, I found that the baker had recently painted the shelves of his shop with this pigment, and the hot loaves placed upon them had taken off a portion of the arsenical paint. It is easy to conceive that an accident of this kind, if undetected, might lead to serious results, and perhaps to erroneous suspicions. ('Medical Times and Gazette,' April, 1854, p. 326.)

Another alleged form of poisoning by this substance, which has attracted some attention, is as it exists in the state of vapour or fine dust applied to the membrane of the lungs, or in the state of powder, applied to the skin. A young man, after having been engaged for nine days in printing with an arsenical green pigment, was seized with irritation and watery discharge from the nose, swelling of the lips and nostrils, and headache. The next day he experienced severe colic, and great muscular weakness: but these symptoms disappeared in about eight days. It is probable that, in this case, the arsenite of copper had been taken into the body through the mucous membrane of the lungs in the state of fine powder. According to M. Bouchardat ('Annuaire de Thérapeutique,' 1846, p. 209), the workmen who handle the emerald-green in making wall-papers are subject to serious disorders of health. They sometimes suffer from eruptions of the skin,—one of the local effects of poisoning by arsenic (see 'Assoc. Med. Journal,' 1856, Sept. 6, p. 757, and Sept. 20, p. 810), with œdema (watery swelling) of the face, and boils frequently forming in the scrotum. There is irritation with discharge of fluid from the mucous membrane of the nose, and abundant salivation. In the more advanced stage there are colicky pains, headache, and prostration of strength. See 'Annales d'Hygiène,' 1847, vol. 2, p. 56; a paper by Dr. Vernois, 1859, vol. 2, pp. 107, 319; and Casper's 'Vierteljahrschrift,' 1859, vol. 2, p. 8; and 'Journal de Chimie,' Juillet, 1858, pp. 394, 397.

Wall-papers covered with the loosely-adhering aceto-arsenite of copper are, from their cheapness as well as their brightness of colour, extensively used in dwellings. This pigment contains fifty-nine per cent. of arsenic, and from some of these papers in the unglazed state, the noxious material may be easily scraped or removed by friction. A square foot may yield from twenty-eight to seventy grains of the arsenical compound, and in rooms exposing five or six hundred square feet, arsenic is thus liable to be distributed in the state of a fine dust or powder through the air of a room. I have detected this poisonous dust on books, pictures, furniture, and projecting cornices in rooms thus papered. Workmen who hang these papers or who strip them off the walls, suffer from symptoms referable only to the action of arsenic. One of my friends who had his library papered with an arsenicated wall-paper, suffered severely from symptoms of arsenical poisoning, which came on after he had been occupied in dusting his books. I examined the dust, and found therein a well-marked quantity of arsenic.

The *Symptoms* produced are of a uniform character, showing their origin from a common cause. They are as follows:—Dryness and irritation of the throat with cough, irritation of the mucous membrane of the eyes and nostrils, dry cough, languor, headache, loss of appetite, nausea, colicky pains, numbness, cramp, irritability of the bowels, attended with mucous discharges, great prostration of strength, a feverish condition, and wasting of the body. These symptoms may not all present themselves in any one case; they are derived from the examination of numerous cases which have been referred to me. No suspicion of the cause had been entertained until all ordinary treatment failed to impart relief, and an analysis of the paper had been made. The connection of the symptoms with this cause appears to have been in some instances clearly established by the fact that after the removal of the paper, especially from bedrooms, the symptoms have disappeared. It is, however, proper to observe that, as in reference to the manufacture of white lead, comparatively few of those who are exposed, suffer from symptoms of poisoning.

Various deaths, chiefly among children, from the use of this paper are now recorded; and it is probable that to the noxious practice of covering the walls of our sitting and bedrooms with arsenic, many insidious cases of illness and chronic disease may be referred. Mr. Orton has lately published in the 'London Medical Review' some remarks on this form of poisoning, with cases demonstrating the danger and fatality arising from the use of the paper. This noxious arsenical compound is also much used for colouring artificial flowers, wreaths, and tarletan dresses. Paper used for adhesive envelopes, for wrapping confectionery, children's food, isinglass, &c., is also frequently coloured with it. So long as the manufacture of this paper is permitted, it is useless to pass any law for restricting the sale of poison.

Analysis.—For the chemical characters of SCHEELE'S GREEN, see page 204. The wall-paper pigment called EMERALD GREEN is a mixture of arsenite and acetate of copper. The colour is most intense, even by candle-light. The presence of arsenic in this compound may be easily detected by all the tests for arsenic (page 201); but the following is a simple method which admits of speedy application. A slip of the suspected paper should be soaked in a moderately-strong solution of ammonia. The colour is removed, and the blue ammoniuret of copper is formed and dissolved in a few minutes. This result establishes only the presence of a compound of copper soluble in ammonia. If the ammonia does not become blue there is no arsenite present: if it does become blue, a large crystal of nitrate of silver must be placed in a white saucer and a small portion of the blue liquid poured over it. The presence of arsenic is revealed by the production of yellow arsenite of silver over the surface of the crystal (page 203).

ARSENIC ACID. ALKALINE ARSENATES.

Arsenic acid is an artificial product almost entirely confined to the chemical laboratory. Orfila states that it is a more powerful poison than arsenious acid, but he does not adduce any instance in support of this opinion. I have not been able to find any case of poisoning by it in the human subject. Dr. Glover ascertained that four grains of the acid, dissolved in two drachms of water, and introduced into the stomach of a rabbit, killed the animal in four hours, with the symptoms of irritant poisoning, and an affection of the nervous system. ('Ed. Med. and Surg. Jour.,' vol. 58, p. 121.)

Analysis.—Arsenic acid is a white uncrystalline deliquescent solid. 1. It is not entirely volatilized when heated on platinum foil in the flame of a lamp. 2. It is very soluble in water, forming a highly acid solution. 3. It is precipitated of a brick-red colour by nitrate or the ammonio-nitrate of silver. In these characters it differs from arsenious acid. 4. It yields readily an arsenical sublimate when heated with charcoal. 5. It yields deposits by Reinsch's process (page 205), but less readily than arsenious acid.

The arsenates of potash and soda must be regarded as active poisons, although there are but few instances on record in which life has been destroyed by them. Dr. Christison states that, in the course of his reading, he has met with only two reported cases of poisoning by arsenate of potash. (Op. cit. 284.) The *tests* are the same as for arsenic acid. A coarse sort of blotting-paper, soaked in a solution of arsenate of potash, is extensively sold under the name of '*Papier Moure.*' It has been erroneously represented that the substance with which it is impregnated, is not poisonous to human beings. (See 'Lancet,' Feb. 11, 1860; also 'Ann. d'Hyg.' 1860, vol. 1, p. 292.)

SULPHIDES, OR SULPHURETS OF ARSENIC. ORPIMENT.

ORPIMENT or YELLOW ARSENIC owes its poisonous properties to the presence of a variable proportion of arsenious acid, sometimes amounting to as much as 30 per cent. of its weight. Orpiment is much employed in the arts, in painting, dyeing, paper-staining, and even in the colouring of toys and sweetmeats for children, but is not often used as a poison! In December 1859 six persons suffered from the usual symptoms of poisoning by arsenic, owing to their having eaten *Bath buns.* It was found that a confectioner at Clifton had used, as he supposed, chromate of lead to give the buns a rich yellow colour, and make them saleable; but the druggist to whom he applied had ignorantly supplied him with orpiment. This wholesale system of poisoning is one of the attendant evils of adulterating articles of food. The *Bradford lozenge cases* (Nov. 1858) furnish a remarkable instance of the impunity attendant upon acts of this kind. A confectioner, intending to adulterate lozenges with plaster of Paris, mixed with them a quantity of white arsenic which had been supplied to him through mistake. I am informed that more than 200 persons partook of these poisoned lozenges, and suffered the usual effects. Seventeen persons died: twelve from acute poisoning, and five from the secondary effects. A trial took place, but the law could not fix the responsibility for the act upon any person.

Symptoms and Appearances.—Orpiment produces symptoms and appearances similar to those caused by arsenious acid; but the dose required to destroy life varies according to the proportion of arsenious acid with which it happens to be mixed. This is not a common form of poisoning; the yellow colour of the poison would lead to suspicion: but by reason of this colour, orpiment may be given or taken, by mistake, for mustard or turmeric. In a case which occurred to Dr. Jochner, two persons partook of some porridge, in which orpiment had been put, by mistake, for turmeric. They suffered from continual vomiting, burning pain in the stomach, and collapse. One, an old man, died in twenty-two hours; the other, a boy, recovered. On inspection, there was violent inflammation of the gullet and stomach, the mucous coat of the latter being softened and thickened. There was a sphacelated spot, one inch in diameter, in the gullet; and another in the stomach, three inches in extent. (Wharton and Stille, 'Med. Jur.' 434.) According to Dr. Chevers ('Med. Jur. for India,' p. 74), orpiment is much used in India both as a medicine and as a poison. He refers to eight instances in which this poison was found, either in food, or in the stomachs of persons who had died under symptoms of irritant poisoning. Orpiment and realgar (another sulphide) are sold openly in India, and are used as depilatories. Orpiment has been known to cause death by *external* application as a depilatory (see 'Annales d'Hygiène,' 1834, 459).

Analysis.—The powdered sulphide yields a solution of arsenious acid on boiling it in water acidulated with hydrochloric acid. It readily gives the well-known sublimates of metallic arsenic, both with soda-flux and ferrocyanide of potassium (see page 202). *Organic mixtures.*—The sulphide being insoluble in water, it is in general easily separated mechanically by allowing the matters mixed with it to become dry upon bibulous paper. If it cannot be separated mechanically, the organic matter suspected to contain it should be dried and boiled with the strongest nitric acid to dryness, until it is destroyed. Any sulphide will then be found under the form of arsenic acid, soluble in water (see page 219).

In *Reg.* v. *Sturt* (Lewes Lent Assizes, 1863), a novel question arose respecting this compound. There was some reason to believe that the deceased woman had died from the effects of arsenic administered in confectionery. White arsenic was found in the stomach, and a question was put by the learned judge, as well as by the counsel for the prisoner, whether the confectioner might not have used yellow arsenic by mistake in order to give a colour, and this yellow arsenic have been converted in the deceased's body in twenty-four hours into white. It need hardly be remarked that the yellow colour is an essential character of orpiment. White may be converted into yellow arsenic in the dead body, but yellow cannot be spontaneously changed into white arsenic.

CHLORIDE OF ARSENIC.

This is a solution of arsenic in diluted hydrochloric acid. It was formerly used in pharmacy, but is now excluded. It contains one grain and a half of arsenious acid in one fluid ounce, which is equal to the small proportion of three-sixteenths of a grain to a fluid drachm. Mr. Phillips states that it is a highly poisonous preparation, and from a case which I saw in Guy's Hospital in May 1857, this statement is confirmed. An adult female took, in three doses, thirty minims over a period of twenty-four hours. The quantity of arsenic thus taken was not more than the *tenth part* of a *grain*, and yet the symptoms which followed were of a severe kind, resembling those of chronic poisoning. These were constriction of the throat, pain and irritation of the stomach and bowels, tingling and numbness of the hands and feet, loss of muscular power, and a feeling of extreme depression. The medicine (a poison) was withdrawn, and the patient slowly recovered. It seems that she had not taken arsenic previously, and there was no evidence of the existence of a peculiar susceptibility to the effects of arsenic. The quantity taken was very small to produce such alarming effects. The usual medicinal dose of this solution was from three to ten minims.

ARSENURETTED HYDROGEN.

This is a gaseous poison of arsenic, producing, when respired in small quantity, very serious effects upon the system. It has already occasioned death in at least four instances. See ('ON POISONS.') One of them is comparatively recent. ('Chemical News,' Dec. 26, 1863, p. 307.)

CHAPTER 19.

POISONING BY MERCURY—CORROSIVE SUBLIMATE—SYMPTOMS—CHRONIC POISONING—FATAL DOSE—APPEARANCES AFTER DEATH—PERIOD AT WHICH DEATH TAKES PLACE—CHEMICAL ANALYSIS—PROCESS FOR MERCURY IN ORGANIC LIQUIDS—WHITE AND RED PRECIPITATES—OTHER COMPOUNDS.

METALLIC MERCURY is not regarded as a poison. A large quantity of it in the fluid state may be swallowed without affecting health, or without causing more uneasiness than that which may arise from its great weight. It rapidly passes through the bowels.

If the mercury is breathed or swallowed in a state of vapour, or if applied to the skin or mucous membrane in a state of extreme mechanical division, in which state it appears to be easily susceptible of oxidation, it is liable to be absorbed, and to produce a poisonous action on the body. The effects are principally manifested by salivation, by trembling and involuntary motions of the limbs, loss of appetite, and emaciation. These symptoms are occasionally seen in workmen engaged in trades, in which they are exposed to the inhalation of mercurial vapours.

Blue pill and *Mercurial ointment* are preparations in which mercury is thus finely reduced, and probably, as in the mixture of mercury and chalk, more or less oxidized. A case in which a female is reported to have died from taking excessive doses of blue pill is reported in the 'Medical Times and Gazette,' vol. 1, 1863, p. 446. Blue or mercurial ointment, which contains nearly half its weight of mercury, has attracted some attention lately by reason of its poisonous effects on cattle. It is employed for the purpose of dressing sheep in place of arsenic, and so much has been used in Lincolnshire, that Mr. Gamgee informs me, twenty-five tons of this ointment had been sold in one year by a druggist in Boston chiefly to farmers. In March 1863 I was consulted in reference to the death of many sheep belonging to a farmer near Stamford; it was supposed that the blue ointment employed was not pure, but that it contained corrosive sublimate or some other deadly poison. The sheep were quite healthy before the ointment was applied, as a dressing for the fly; but soon afterwards, they began to die at the rate of six per diem, until upwards of forty were lost. The chief symptoms preceding death were short breathing with a peculiar grunt indicative of pain, and the heads of the animals drooped to the ground. On inspection the lungs were generally found congested. On analysis the ointment was found quite pure. Mr. Gamgee informs me that he has been consulted in cases in which sheep have been poisoned by repeated dressings with blue ointment; and he affirms that ruminants are more easily killed by such an application than other animals. He found that sheep thus poisoned with mercury, had been sent for sale to the dead-meat markets in London, and that they had realized more money than sound mutton sold in the county of Lincoln. I agree with him, that this practice of inunction with mercury should be suppressed: it is not only injurious to cattle, but is often an unsuspected source of noxious food to human beings. Mercury with chalk is commonly regarded as an innocent medicinal compound of the metal; but if long kept and exposed to light a portion of the mercury passes to the highest state of oxidation, and thus produces a poisonous effect upon the system. This may account for the severe symptoms which have sometimes resulted from this preparation in medicinal doses. Drs. Duncan and Seely, who have investigated the changes, state that in one specimen which should have contained 37·5 parts of metallic mercury, 4·05 parts had become converted into the black oxide, and 22·25 parts into red oxide.

Corrosive Sublimate.—This substance has received a variety of chemical names. It has been at various times called *Oxymuriate*, *Chloride*, *Bichloride*, and *Perchloride* of *Mercury*. To prevent any confusion from scientific chemical nomenclature, the old and popular name of *Corrosive Sublimate*, expressing the principal properties of the substance, is here retained. It is commonly seen under the form of heavy crystalline masses, or of a white crystalline powder. Its *taste* is powerfully austere and metallic, so that no poisonous quantity of it could be easily swallowed, without the person becoming immediately aware of it. It is very *soluble* in water, hot or cold, and speedily sinks in it, in which properties it differs strikingly from arsenic. I have found by experiment that one hundred grains of a cold saturated solution hold dissolved, at a maximum, ten grains of corrosive sublimate; and it is stated by most chemists that two parts of boiling water (212°) will dissolve one part of the poison. It is also readily dissolved by alcohol and ether.

Symptoms.—The symptoms produced by corrosive sublimate generally come on immediately or within a few minutes after the poison has been swallowed. In the first place there is perceived a strong metallic taste in the mouth, often described as a coppery taste; and there is, during the act of swallowing, a sense of constriction almost amounting to suffocation, with burning heat in the throat, extending downwards to the stomach. In a few minutes violent pain is felt in the abdomen, especially in the region of the stomach, which is increased by pressure. Pain in the abdomen has been sometimes wholly absent. There is nausea, with frequent vomiting of long stringy masses of white mucus, mixed with blood; and this is followed by profuse purging. The countenance is sometimes swollen and flushed, in other cases it has been pale and anxious. The pulse is small, frequent, and irregular, and is scarcely perceptible when the symptoms become aggravated. The tongue is white and shrivelled,—the skin cold and clammy, the respiration difficult; and death is commonly preceded by fainting, convulsions, or general insensibility. The external parts of the mouth, when examined, are swollen, and sometimes present an appearance as if the cavity had been washed with a solution of nitrate of silver: the lips are often swollen. Suppression of urine has also been frequently noticed among the symptoms. It existed in a well-marked case of poisoning by this substance, at Guy's Hospital:—the patient lived four days, but did not pass any urine during the whole of this time. (Guy's Hospital Reports, April, 1844, p. 24.) This symptom was observed in a case reported by Dr. Wegeler (Casper's Wochenschrift, Jan. 10, 1846, p. 30), in which a youth, æt. 17, swallowed three drachms of this poison, and died on the sixth day. During the last three days, no urine was secreted. The case was otherwise remarkable from the fact, that no pain was experienced on pressure of the abdomen, and that the pulse underwent no change until shortly before death. In another case, reported by Dr. Herapath, in which a scruple of corrosive sublimate in solution was swallowed, suppression of urine and salivation came on on the third day, and the patient died on the ninth day. ('Lancet,' Dec. 13 and 27, 1845, pp. 650, 698.) In a case observed by Mr. Morris, the quantity of urine secreted was small, and it produced a scalding pain when voided. ('Prov. Med. Jour.' Nov. 18, 1843, p. 126.) In this instance there was no purging.

The *external* application of corrosive sublimate to tumors or ulcers may destroy life with all the usual symptoms of acute mercurial poisoning. At the Winchester Lent Assizes, 1859 (*Reg.* v. *Crook*), a quack was convicted of manslaughter by applying corrosive sublimate in powder to a cancerous tumour in the face of deceased. The man suffered from the usual symptoms. After death the bowels were found extensively inflamed and ulcerated. Mr. May, of Reading, detected corrosive sublimate in the diseased part.

This poison differs from arsenic: 1, in having a well-marked taste; 2, in producing violent symptoms in a few minutes; and 3, in the fact that the evacuations are more frequently mixed with blood. The symptoms produced by corrosive sublimate, in the first instance, resemble those of cholera; if the individual should survive several days, they are more like those of dysentery,—violent straining, and mucous discharges mixed with blood, being very frequently observed.

Slow or chronic Poisoning.—The symptoms are much modified when the poison is taken in small doses at intervals for some days or weeks. There are colicky pains with nausea, vomiting, general uneasiness, and depression. The salivary glands become inflamed and painful; the tongue and gums are red and swollen, sometimes ulcerated, and there is fœtor of the breath. A deep blue line, like that observed in poisoning by lead, is sometimes found around the edges of the gums. The patient experiences difficulty of swallowing and breathing. The constitutional effects are indicated by looseness of the bowels, difficulty of breathing, spitting of blood, cough, general trembling or convulsive movements of the limbs, and palsy, with slow fever and emaciation, under which the patient sinks. One of the most marked effects of slow or chronic poisoning by mercurial preparations is *salivation*, or ptyalism, indicated by an increased flow of saliva. This is by no means a necessary symptom in cases of acute poisoning by corrosive sublimate, but it not unfrequently shows itself about the second or third day. In some instances the patient dies too rapidly for this effect to follow; but even when he survives some days, salivation is not always observed. In placing reliance upon this symptom, it must be remembered that salivation may arise from a variety of causes irrespective of the use of mercury.

Appearances after Death.—These, as in the case of arsenic, are chiefly confined to the alimentary canal. Corrosive sublimate, however, affects both the mouth and throat; the mucous membrane is softened, of a white or bluish grey colour, and sometimes inflamed; that lining the gullet is similarly affected, and partly corroded and softened. The mucous membrane of the stomach is more or less inflamed, sometimes in patches; and there are masses of black extravasated blood found beneath it. Occasionally it has a slate-grey colour and the mucous coat beneath may be found reddened. A case occurred in Guy's Hospital, in which the mucous membrane was simply inflamed: it much resembled the condition presented in cases of arsenical poisoning. The coats of the stomach are sometimes corroded, and so much softened that they cannot be removed from the body without laceration. Similar appearances have been met with in the small and large intestines, especially in the cæcum. In a case reported by Dr. Herapath, in which a scruple was taken, and death occurred on the ninth day, the mucous membrane of the stomach was softened, but there were no well-marked appearances of the action of the poison on this organ. The cæcum had been the seat of the most violent inflammation, the whole surface being of a deep black-red colour, and there were patches of sloughing in the coats. ('Lancet,' Dec, 27, 1845, p. 700.) In a case which occurred to Dr. Thomson, of Perth, in which a man died forty hours after having swallowed two drachms of corrosive sublimate in powder, the mucous membrane of the stomach, duodenum, upper portion of the ileum, and parts of the large intestines, were found of a bright red colour. This appearance was most marked at the cæcum and sigmoid flexure of the colon. The local action of the poison on the mouth and throat was in this instance considerable. ('Edinburgh Monthly Journal,' Dec. 1851, p. 532.) Perforation of the stomach is rare as an effect of this poison: there is, I believe, only one case on record. Appearances like those just described, have been seen in the alimentary canal, not only where the case has terminated fatally in a few hours, but where it has been protracted for six, eight, and even eleven days. (Chaussier, 'Recueil des Mémoires,' p. 363.) In the case of a man, æt. 42, who swallowed, by mistake, thirty grains of this poison dissolved, and who died on the twelfth day, the stomach was found empty, the mucous membrane was of a dull, dark red colour, chiefly about the smaller curvature. It was softened, and near the intestinal end was grey, pulpy, and gangrenous. In the gullet, the lining membrane appeared to have been stripped off in shreds. The intestines were in a state of intense inflammation, passing into gangrene. The other viscera presented no particular appearance. In this case the symptoms were manifested in a few minutes: there was a burning pain down the gullet to the stomach, described as if the parts were on fire; there was no mark of corrosion in the mouth; there was a sensation as if the throat was 'grown up:' and there was blood in the vomited matters as well as in the evacuations. There was no salivation at any period. ('Med. Times and Gaz.,' Feb. 26, 1859, p. 210.)

Quantity required to destroy Life.—The *smallest* dose which is reported to have destroyed life is *three* grains. This was in the case of a child, and the quantity was accurately determined from the fact of its having been made up by mistake for three grains of calomel, which a physician intended to order. (This case is referred to in the 'Lancet,' 1845, p. 297.) It is probable that, under favourable circumstances, from three to five grains, or even less, would destroy an adult. Persons who had taken large doses have been known to recover when remedies were timely administered, or early vomiting was produced ('Med. Times and Gaz.,' Feb. 18, 1860, p. 162); and sometimes recovery has been wrongly attributed to the remedy. In May 1862, a man swallowed eighty grains of corrosive sublimate dissolved in whisky and water. In ten minutes violent vomiting occurred. A mixture of albumen and milk was first given, and in about twenty-five minutes, gold-leaf with reduced iron made into a bolus. Some warm water had been previously administered in order to clear the stomach of any albumen or mucus. Vomiting recurred with less violence,—the matters being mixed with gold-leaf. On the next day, there was no salivation, but in about eight days the man perfectly recovered. ('Ann. Jour. Med. Sci.,' April 1863, p. 340.) Dr. Johnston attributed the recovery o the gold and iron, but there is not the slightest evidence that the metals had xerted any galvanic action in decomposing the corrosive sublimate: on the ontrary, the particles of gold-leaf rejected after the administration of the ntidote were apparently unchanged. The recovery was, no doubt, due to he early vomiting, and the free use of albumen and milk.

Period at which Death takes place.—In an acute case, an individual commonly dies in from one to five days; but death may take place much sooner r later than this. The shortest fatal case on record was communicated to me y Mr. Welch. The quantity of poison taken was not ascertained, but the man died in less than *half an hour*. ('ON POISONS, CORROSIVE SUBLIMATE.') n a case reported in the 'Edinburgh Monthly Journal,' vol. 1, 1860, p. 958, n adult who took from sixty to eighty grains of corrosive sublimate, did not e until the *twelfth day*. The case was somewhat peculiar. On the first day here was no complaint of pain in the gullet or stomach; the throat was painful on the second day, and the mouth and gums were affected on the third day. On the eighth day the man had apparently recovered, but he gradually became weaker, and died on the twelfth day.

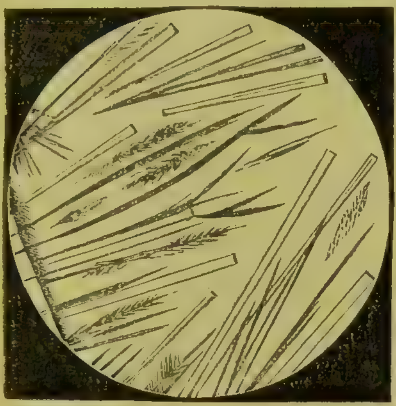
The subjoined cases, which are of recent occurrence, show the general effects of the poison in causing death rapidly or slowly. The first of these, which occurred in September, 1861, is reported by Dr. Skegg. 'Lancet,' Feb. 1, 1862.) In this case a large dose of corrosive sublimate (112 grains) caused death in three hours and a quarter. In the second, which occurred at Guy's Hospital in November 1861, about five grains of corrosive sublimate caused death in six days: in both cases the poison was taken dissolved.

In Dr. Skegg's case, a man, æt. 54, swallowed two pennyworth of the poison (a quarter of an ounce) at 11 A.M. When seen by Dr. Skegg soon afterwards, he was on the bed in a state of great prostration: his skin was blanched, and covered with a cold clammy perspiration; he vomited a thick stringy albuminous-looking substance. There was intense pain over the abdomen, and great purging with discharge of blood: the pulse was scarcely perceptible, the membrane of the tongue and of the interior of the mouth was perfectly white from the local action of the poison. White of egg was given freely, and a mustard poultice applied to the abdomen. At one o'clock he was more depressed. At a quarter past two, Dr. Skegg again saw him, and found he had just expired. An inspection was made twenty-four hours after death. The external coat of the stomach was of a deep red colour. The mucous membrane internally had the appearance of a piece of dark crimson velvet, owing to the large quantity of blood extravasated. The intestines here and there were reddened. The great omentum for about an inch from the stomach was of a deep crimson hue. The other organs were healthy.

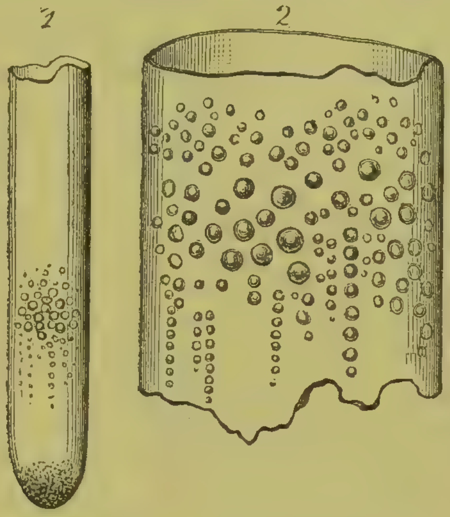
In the second case, in which only five grains of the poison, dissolved in vinegar, were swallowed by a man, æt. 25, the following symptoms were observed on his admission into Guy's Hospital. Immediately after swallowing it, he felt a burning heat in his throat, and vomited freely. In two hours, there was great pain in the abdomen, he passed blood in his evacuations, and brought up a thick yellow frothy matter, tinged with blood. There was suppression of urine. He died on the sixth day. On inspection, the gullet presented marks of the local action of the poison. The mucous membrane of the stomach was reddened, and throughout minutely injected. There was no appearance of chemical corrosion. The small intestines at their lower part, as well as the large intestines, were deeply injected. The cæcum was but slightly affected. Seven ounces of the liver, and one half of the stomach, gave only minute traces of mercury. The greater part of the poison had been discharged by vomiting or by elimination during the six days which the patient survived.

Stellated crystals obtained by heating corrosive sublimate, magnified thirty diameters.

Chemical Analysis.—Corrosive sublimate is usually seen in heavy crystals, or in the form of a crystalline white powder as a *solid.* 1. When the powder is heated on platinum foil or mica, it melts, and is volatilized in a white vapour without leaving any residue. 2. When heated in a close tube, it melts and forms a sublimate, consisting of prismatic crystals sometimes stellated. 3. The powder is changed in colour by the following reagents: iodide of potassium produces a bright scarlet, potash a yellow, and sulphide of ammonium a black precipitate; ammonia does not alter its colour. 4. The mercury and chlorine may be discovered by one process. Mix the powder with four parts of dried carbonate of soda (obtained by incinerating the bicarbonate), until the residue in the reduction tube fuses and becomes white. A sublimate of metallic mercury in distinct and well-defined globules will be obtained. Detach by a file, the end of the tube containing the fused residue, which is chloride of sodium with some undecomposed carbonate. Digest it in water with nitric acid, and apply heat until it is entirely dissolved: then add to the solution nitrate of silver. A white precipitate of *chloride* of silver, insoluble in nitric acid, will be at once produced. The solid is thus proved to contain both mercury and chlorine, and the only compound of these elements soluble in water,



Prismatic crystals of corrosive sublimate from solution in water, magnified thirty diameters.

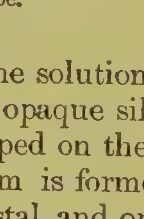


1. Mercury sublimed in globules, from corrosive sublimate, in a reduction-tube.

2. The same, magnified.

is corrosive sublimate. In *solution* in water. A few drops of the solution of corrosive sublimate evaporated in a glass slide yield slender opaque silky prisms. When a weak solution of iodide of potassium is dropped on them, they acquire a bright scarlet colour, and chloride of potassium is formed. These characters, which may be obtained from the minutest crystal and only one drop of solution, prove that the body dissolved in water is corrosive sublimate: it is thus distinguished from every other mineral poison, and all other substances whatever. 1. Protochloride of tin added to a solution of orrosive sublimate, produces a black precipitate which, after it has been boiled, s resolved into globules of metallic mercury. 2. Sulphuretted hydrogen and ulphide of ammonium produce, after a time, a black sulphide, not soluble in lkalies or diluted acids. 3. If the liquid is acidulated, and bright copper foil, wire, or gauze, is plunged into it, the copper will acquire a silvery-white eposit, even in the cold, but more rapidly by heat. When the copper with he metallic deposit is heated in a tube, globules of mercury are obtained.

In Organic Liquids.—The liquid should be separated by filtraion from any insoluble portions. The latter should be pressed, ried, and set aside for a separate analysis. A slip of bright opper-foil or gauze may be employed as a trial test in the anner above described. In place of copper, a small galvanic ombination, made by twisting a layer of gold-foil round a layer f zinc-foil, may be introduced. The liquid should be slightly cidulated with hydrochloric acid and warmed. The metals hould be suspended in the liquid for some hours. If the merurial poison is present, even in small quantity, the gold will oner or later lose its colour and become silvered, while the zinc ill be wholly or in part dissolved. The slip of gold-foil may be ashed in water, and afterwards in ether and dried. It should be divided into



A layer of gold-foil round zinc-foil.

two equal portions. One should be submitted to heat in a tube, when globules of mercury will be obtained; the other should be heated in a few drops of concentrated nitric acid, until the gold has reacquired its yellow colour. On evaporating the excess of acid, and adding a solution of protochloride of tin, a dark grey precipitate of metallic mercury is thrown down. It may be remarked that sublimed mercury is wholly unlike any other volatile substance. The perfect sphericity of the globules, their silvery whiteness by reflected, and complete opacity by transmitted light, at once identify them as metallic mercury. The sublimate of metallic mercury differs from that of arsenic in the fact that when heated, it sublimes simply as metal without change. It is not oxidized (like metallic arsenic), by heating it in a reduction-tube, but is simply transferred with its metallic lustre from one part of the tube to another. The mercurial sublimate is soluble in nitro-hydrochloric acid, yielding on evaporation prismatic crystals of corrosive sublimate.

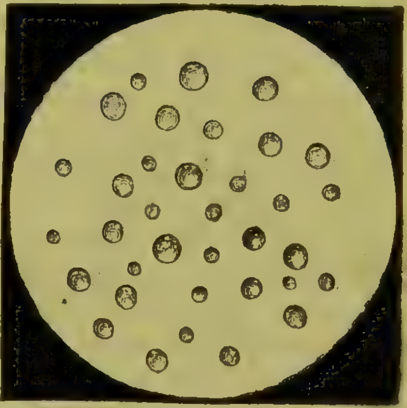
The yellow colour of the gold may not have been concealed by the mercurial deposit, owing perhaps to its great tenuity. Hence it is always proper to heat the gold in a reduction tube before coming to the conclusion that mercury is absent. The tube itself may not show a sublimate to the naked eye, owing to the minuteness of the globules, and their being much scattered. In all cases the tube should be examined, at first with a low, and subsequently with a high power of the microscope. Minute strings of globules, varying from the 1-8000th to the 1-16000th of an inch in diameter, may thus be detected. They are frequently deposited in a kind of chain in any minute crack or line on the interior of the glass tube.

In the event of a doubt existing respecting the mercurial nature of the sublimate, the following experiment will remove it. Cut off by a file the portion of glass in which they are deposited : introduce this into a wide short tube, with a few drops of hydrochloric and half the quantity of nitric acid. Heat the acid liquid, and carry it to dryness on a sand-bath. White prismatic crystals of corrosive sublimate will remain, if the sublimate was of a mercurial nature, and too great a heat has not been applied. On touching the white residue cautiously with a drop of solution of iodide of potassium, the crystals will acquire a scarlet-red colour.

Another method of analysis may be sometimes usefully resorted to. Place the suspected organic liquid in a small golden capsule. Acidulate it slightly with hydrochloric acid, and touch the gold, through the acid liquid, with a slip of pure zinc foil. Mercury will be deposited in a white silvery stain on the gold, wherever the two metals have come into contact. Wash out the capsule with distilled water, and add a few drops of strong nitric acid. Pernitrate of mercury is thus obtained, which may be tested by the processes above described for the detection of the persalts of mercury. Any solid precipitates, or insoluble compounds, of mercury, may be dissolved by strong nitric acid, and the solution tested for the metal. If none is found, the dried solid, mixed with dried carbonate of soda, may be heated in a tube, when mercury, if present, will be volatilized.

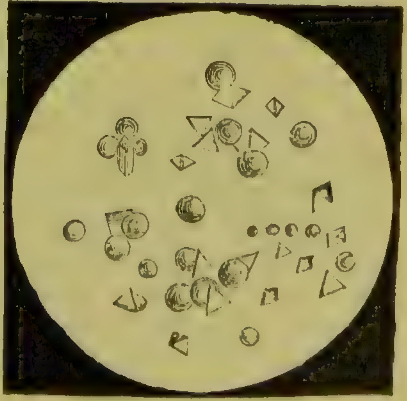
Absorbed Mercury.—Although absorbed mercury, like other metals, is eliminated from the system, yet its elimination through the ordinary secretions appears to be slow, and subject to some uncertainty with respect to the time at which it occurs, as well as to the duration of the process. That it is rapidly absorbed and deposited in the tissues of the organs, is undoubted; but when once deposited, the period for its entire elimination can scarcely be predicted. Mercury in a man or animal, labouring under its immediate effects, cannot be so readily detected in the urine as arsenic. Mr. Tuson, of the Royal Veterinary College, informs me that he gave to a mare, at first four grains, and afterwards five grains of corrosive sublimate twice a day. At the end of fourteen days, he tested a pint of the urine for mercury, but found none. After the lapse of three weeks, it was easily discovered in this fluid. The animal then left the infirmary. In a case of chronic poisoning by mercury, to be presently mentioned (see page 234), mercury could not be detected in twelve ounces of urine which were voided while the patient was labouring under the effects of the absorbed poison, although several weeks had elapsed, and mercury was detected in the tissues after death. In the search for mercury in living persons labouring under this poison, a large quantity of urine should be examined, and an analysis made at intervals.

The urine may be evaporated to dryness, and the dry residue or extract treated by the following process, which is the same as that required for the *tissues*. From four to eight ounces of the liver or other organs should be dried, broken up, and then boiled until dissolved, in one part of pure hydrochloric acid and four parts of water. The acid liquid may be strained through linen, and the residue pressed. The liquid, if in large quantity, should now be concentrated by gentle evaporation, and while still slightly warm, a piece of copper-gauze (proved to be free from mercury) should be introduced, at the end of a fine platinum wire, into the acid liquid. The copper may acquire a white, grey, or silvery tarnish in a few minutes or not until after twenty-four hours. It may be removed, washed in water and alcohol, and dried and examined by a low power of the microscope. The deposition of any white metal on the copper will then be perceptible. It may be rolled into a pellet and heated in a dry reduction-tube, when minute globules may appear as a sublimate. The sublimate in the tube should be examined with a microscope, and the copper should in all cases be heated, whether the red colour of this metal appears to be covered or not by any deposit.


A small sublimate of mercury, magnified 124 diameters.

The efficiency of this method of detecting mercury when absorbed and deposited in the tissues, is indicated by the following fact. In an alleged case of poisoning (May 1864) a child died after an illness of twenty-two hours. Fourteen hours before death, two grains of calomel had been given to it. This had caused much purging, and mercury was found in one of the last evacuations passed. Four ounces of the liver were treated with hydrochloric acid and water, and a small piece of pure copper placed in the acid liquid while warm, and kept there for about forty-eight hours. It acquired a slight silvery lustre, and globules of mercury were obtained from it by sublimation.

If arsenic should be present in the tissues at the same time, and the acid mixture is boiled, arsenic and mercury will be deposited together; and when the copper is heated, the globules of mercury will be obtained nucleated or intermixed with octahedral crystals of arsenious acid. In a case of exhumation after twenty-one months' burial, these mixed sublimates were obtained by the examination of the rectum of the deceased. (*Reg.* v. *Bacon*, Lincoln Summer Assizes, 1857.) It appeared in evidence that arsenic had been administered to the woman a day or two before death, and a dose of calomel had been prescribed more recently. This accounted for the presence f the mixed sublimates.


Mixed sublimate of mercury and arsenious acid magnified.

Arsenic is not readily deposited on copper in the cold, while mercury is readily deposited at all temperatures from acid liquids. We may sometimes take advantage of this difference in chemical properties, to obtain a separate deposit of this metal.

The processes above described reveal only the presence of mercury. When the quantity of corrosive sublimate dissolved in an organic liquid is moderately large, it may be removed by means of ether. Place the filtered liquid supposed to contain the poison, in a stoppered tube: add to it, twice its volume of pure ether, and agitate the liquid at intervals for half an hour. Allow the liquid to subside, pour off the ether into a dial-glass, and submit it to spontaneous evaporation. As the ether passes off, the corrosive sublimate will be deposited in white silky-looking prisms. These may be purified by solution in water if necessary, and the solution again crystallized. Corrosive sublimate may thus be separated from arsenic and other mineral poisons in solution. If mercury and arsenic are associated in a poisonous mixture, or in the tissues, the arsenic may be entirely separated by distillation (page 208). Masses of corrosive sublimate may be sometimes locked up in thick viscid mucus; and in such cases, the coarse powder being heavy, it may be separated by simply agitating the viscid liquid in water, and then decanting the upper portion suddenly. This poison is decomposed and precipitated by many organic principles, such as albumen, fibrin, mucous membrane,—also by gluten, tannic acid, and other vegetable substances. Thus, then, we cannot always expect to find it in the stomach, in a state of solution. Mercury is not a constituent of the body. The discovery of it in the tissues, therefore, proves that it must have been received *ab extra*.

By one or other of these processes, we may be able to show the presence of *mercury*, but not of corrosive sublimate, in the body. Whether the mercurial compound had acted as a poison or not, must be determined from symptoms and appearances: whether it had been given or taken as a medicine or not, is a conclusion which must also be determined from other circumstances. The proof that the mercury was really in the form of corrosive sublimate, could only be derived from the discovery of some undissolved portions of the solid poison in the stomach or its contents, or from a separation of the poison itself by means of ether. If thus obtained after filtration of an organic liquid, it would show its presence in the form of a soluble salt: all the soluble salts are poisonous, and are rarely used internally as medicines. If undissolved, the absorbed mercury may have been derived from some mercurial medicine innocently taken by the deceased. Nothing is more common than to discover traces of mercury in the stomach, bowels, liver, kidneys, or other organs of a dead body. No importance can be attached to this discovery in the absence of evidence that the deceased has actually suffered from symptoms of mercurial poisoning. As to the mercury found in the tissues, it may have been derived from a soluble or insoluble compound, or from exposure to the vapours of the metal, or of its salts, in various trades.

A person may die from the effects of corrosive sublimate, and no mercury may be found in the tissues. A case of this kind occurred to me some years since at Guy's Hospital; and another, in which deceased died in fifteen days from a large dose of corrosive sublimate in whisky, has been reported by Dr. Geoghegan. On this occasion, although the local effects of the poison on the throat, stomach, and bowels, were of an intense kind, the viscera on careful analysis, yielded no trace of mercury: the metal had been entirely eliminated in fifteen days. ('Med. Gaz.' vol. 46, p. 253.)

CALOMEL. *Subchloride of Mercury.* This substance, although commonly regarded as a mild medicine, is capable of destroying life, in small doses, by causing excessive salivation with ulceration and gangrene, and in large doses by acting as an irritant poison.

Analysis.—It is known from corrosive sublimate by its insolubility in water, alcohol, and ether. It is known from white precipitate by its insolubility in acids, and by its being blackened by alkalies. A mercurial sublimate may be obtained from it by heating it with dry or anhydrous carbonate of soda.

White Precipitate. *Ammoniated Mercury.*—A few years since it was a contested question whether white precipitate was or was not a poison: and at the Chelmsford Lent Assizes in 1850, a woman who was indicted for administering this substance to her husband, owed her acquittal to the lenient assumption in her favour that it was *not* a poison. Out of fourteen cases which I have collected, in which white precipitate was taken in doses varying from a few grains to forty,—two only proved fatal; and one of these was the subject of a trial for murder (*Reg.* v. *Moore*, Lewes Lent Assizes, 1860). The symptoms which it produces are violent vomiting, cramps, purging and pain in the stomach with convulsions. After death there is more or less inflammation of the stomach and bowels. In August 1863 a woman, æt. 30, swallowed a pennyworth of white precipitate and shortly afterwards a pennyworth of acetate of lead. In half-an-hour, there was violent vomiting and pain over the whole of the abdomen. An hour and a-half afterwards the symptoms were, in addition to the abdominal pain, great thirst and a comatose condition. On the second day, there was slight tenderness of the gums, a flow of saliva, flushed face, with great tenderness of the abdomen; and on the fourth day profuse salivation. This subsided on the tenth day, and the woman recovered. ('Med. Times and Gazette,' 1863, 2, 645.) Dr. Pavy's experiments on dogs and rabbits show that this is a more formidable poison than it has been hitherto supposed to be. The greater number of recoveries were probably owing to the substance being early ejected by vomiting. Rabbits, which do not vomit, were killed by a dose of four and five grains in a few hours. After death, mercury was found deposited in various organs, but more in the kidneys than in the other viscera. (For additional facts connected with the action of this poison, see 'Guy's Hosp. Reports,' October, 1860, p. 483.)

Analysis.—White precipitate is an insoluble chalky-looking compound containing about eighty per cent. of mercury. As it is sold in the shops, it frequently contains corrosive sublimate to the amount of one or two per cent. It is not used internally, but it is much employed by the poorer classes in the treatment of ringworm. It is soluble in acids, is not blackened by alkalies, and it yields a mercurial sublimate when heated with carbonate of soda. If boiled in a solution of potash, it evolves ammonia, and yellow oxide of mercury is precipitated. It may be detected in organic fluids and solids by boiling them in one part of hydrochloric acid and four parts of water. The mercury may then be separated by means of copper (p. 229).

Red Precipitate. *Red Oxide of Mercury.*—This substance is poisonous, but instances of poisoning by it are very rare. The following case occurred at Guy's Hospital in 1833. A woman, æt. 22, who had swallowed a quantity of red precipitate, was brought in labouring under the following symptoms: the surface was cold and clammy, there was stupor approaching to narcotism, frothy discharge from the mouth, and occasional vomiting: the vomited matters contained some red powder, which was proved to be red precipitate. There was considerable pain in the abdomen, increased by pressure; and there were cramps in the lower extremities. On the following day, the throat and mouth became painful, and the woman complained of a coppery taste. The treatment consisted in the use of the stomach-pump, and the free administration of albumen with gluten. She left the hospital four days afterwards, still under the influence of mercury. The quantity of oxide here taken, was not ascertained.

Analysis.—Its red colour identifies it. When heated in a close tube, it is resolved into oxygen and mercury which is deposited in globules.

CINNABAR. VERMILION. *Persulphide of Mercury.*—The term *Cinnabar* is applied to a dark and heavy compound of sulphur and mercury, while *Vermilion* is the same substance reduced to a fine powder. It is well known as a red pigment, and is often employed in colouring confectionery and wafers. It is stated to have proved fatal to animals in the proportion of from thirty to seventy grains, when applied externally to a wound. Cinnabar is sometimes used for giving a red colour to ointments, *e.g.* the sulphur ointment; and it is also improperly employed by some dentists as a colouring matter to vulcanized rubber for mounting artificial teeth. Although this insoluble compound of mercury cannot be regarded as an active irritant poison in the stomach, the placing of it in such a situation that it should be always in contact with the mucous fluids of the mouth, is liable to lead to the usual consequences of chronic poisoning by mercury. In May 1864, a medical man consulted me under the following circumstances. Upon the recommendation of a dentist, he had worn this red composition as a frame for false teeth, in place of gold. After some time he perceived a metallic taste in his mouth, the gums became inflamed and ulcerated, there was great weakness and want of nervous power, with pains in the loins and an eruption on the legs. When the composition was removed, these symptoms abated. I examined the substance, and found in it a great quantity of vermilion: it had been mixed with the sulphur and rubber to give the appearance of the red colour of the gums. Dr. Wells, of Reading, has directed the attention of professional men to accidents of this nature. A patient of his, who had been provided with a frame of this description for the upper and lower jaws, perceived, soon after wearing it, a metallic taste in his mouth. His health failed, he lost his appetite and became emaciated: he suffered from flatulency, fœtid breath and looseness of the bowels: his pulse was 100 and weak, and his tongue coated with a white film. This gentleman was peculiarly sensitive to the action of mercury. He left off wearing the teeth, and he became gradually better and stronger. ('British Med. Journal,' Sept. 5, 1863, p. 366.)

Dr. Sutro has published a short abstract of a case in which the *vapour of vermilion* applied externally, produced severe symptoms. A woman, by the advice of a quack, applied this vapour to a cancerous breast. She employed three drachms of vermilion, and covered herself with a sheet, so that the vapour should only reach the body externally. After three fumigations, she suffered from severe salivation and violent fever, which continued for four weeks. The right arm became œdematous. ('Med. Times,' Sept. 27, 1845, p. 17.)

Analysis.—Vermilion, or the organic compound containing it, may be entirely decomposed by nitro-hydrochloric acid. The residue evaporated to dryness contains corrosive sublimate. This may be taken up by water and the usual tests applied (p. 227). Ether will separate corrosive sublimate from the aqueous solution. The vermilion contained in vulcanite, was thus readily analysed. The red sulphide of mercury is not blackened like red lead by sulphide of ammonium, and is not dissolved by hydrochloric acid like red oxide of mercury. It yields an alkaline sulphide and globules of metallic mercury, when heated with powdered ferrocyanide of potassium.

CYANIDE OF MERCURY.—This is a substance which is but little known, except to chemists, yet it is an active poison, and has caused death in at least two instances. In April, 1823, a person who had swallowed twenty grains of this compound (thirteen decigrammes), was immediately seized with all the symptoms of poisoning by corrosive sublimate, and died in nine days. There was continued vomiting, with excessive salivation, ulceration of the mouth and throat, suppression of urine, purging, and, lastly, convulsions of the extremities. On inspection, the mucous membrane of the stomach and intestinal canal was extensively inflamed. ('Orfila,' vol. 1, p. 735.) Dr. Christison quotes a case in which ten grains destroyed life within the same period of time. (Op. cit. p. 427.) As a poison, the cyanide is not much inferior in activity to corrosive sublimate, but it has no corrosive properties.

TURPETH MINERAL. *Subsulphate of Mercury.*—Fatal cases of poisoning by this compound are by no means common. Although insoluble in water, it is undoubtedly an irritant poison, and is capable of causing death in a comparatively small dose. A well-marked instance of its fatal operation was communicated to the Pathological Society by Mr. Ward, in March, 1847. A boy, æt. 16, swallowed *one drachm* of this preparation on the night of February 19th. It produced a burning sensation in the mouth and throat, and vomiting in ten minutes. In about an hour there was paleness, with anxiety of countenance, coldness of surface, constant sickness, sense of heat and constriction in the throat, and burning pain in the stomach, with cramps. The irritability of the stomach continued in spite of treatment, and after two days there was salivation with mercurial fœtor. The gums acquired a deep bluish tint, and began to ulcerate. The patient died in about a week after taking the poison, without convulsions, and without suffering at any period from symptoms of cerebral disturbance. The principal appearances in the body were inflammation of the gullet, its mucous membrane at the lower part peeling off; the inner surface of the stomach near the two openings (cardia and pylorus) was covered with petechial spots; the small intestines were contracted, the inner coat reddened, and petechial spots were found, but chiefly in the large intestines. The parotid and submaxillary glands were swollen. Mercury was detected in the intestines. (See 'Med. Gaz.' vol. 39, p. 474.) Mr. Snoad, of Yoxall, has communicated to me the particulars of another case which was the subject of a trial for manslaughter at the Stafford Lent Assizes 1862. A young man, æt. 27, by the mistake of a druggist, was supplied with turpeth mineral in place of Æthiop's mineral. He swallowed about two scruples of it, on an empty stomach, with a like quantity of cream of tartar and treacle. In ten minutes he was seized with violent vomiting and purging, the pulse was slow and small, the skin cold and clammy, and there was pain in the abdomen, especially in the region of the stomach. Under treatment the symptoms of irritation abated, but never entirely subsided, and he died quietly on the eleventh day after taking the poisonous mixture. On inspection the principal appearances were softening of the mucous membrane of the stomach and intestines, with patches of inflammation and dark discolouration. A small portion of the liver yielded mercury when treated with copper and hydrochloric acid.

NITRATES OF MERCURY.—These are corrosive poisons which are used for various purposes in the arts. They are solid white salts, easily dissolved by cold water when there is a little excess of acid present. The acid pernitrate caused death in a case reported by Mr. Bigsley in the 'Medical Gazette,' vol. 6, p. 329. A butcher's boy dissolved some mercury in strong nitric acid, and swallowed about a teaspoonful of the solution. Soon afterwards he suffered excruciating pain in the throat, gullet, and stomach:—there was great anxiety, with cold skin, small pulse, colic, and purging. He became gradually weaker, and died in about two hours and a half. On inspection, the throat, gullet, and stomach were found corroded and inflamed. Although he survived so short a time, the mucous membrane of the stomach was of a deep red colour. I have elsewhere related a case in which the application of the pernitrate of mercury to the throat as an escharotic, caused immediate death by asphyxia. ('Guy's Hospital Reports,' Oct. 1850, p. 206.) The acid nitrate of mercury has often been employed by accoucheurs as a local application in diseases of the neck of the uterus. In one instance in which it was thus used, the ordinary symptoms of mercurial poisoning showed themselves, and the patient appears to have suffered severely. ('Medical Gazette,' vol. 45, p. 1025.)

At the Leicester Summer Assizes, 1857, a girl was charged with administering nitrate of mercury to her mistress (*Reg.* v. *E. Smith*). The evidence showed that the accused had put the poison into some camomile tea prescribed for the prosecutrix. Only a small quantity was taken, as the tea had a nauseous taste. The symptoms were:—a burning sensation in the throat and stomach, violent vomiting, with severe pain in the abdomen. The woman recovered. A man, æt. 32, suffering from chronic poisoning by the nitrate of mercury, was admitted into Guy's Hospital on the 10th December 1863. He had been for four years engaged in packing the fur of rabbits, rats, and other animals, the dried skins of which had been previously brushed over with a solution of nitrate of mercury. For the first three years, he suffered only from a feeling of general weakness. About a twelvemonth since, he could not hold his hand steadily enough to shave himself, and he soon afterwards lost completely the control over the voluntary movements of his limbs. Three or four months before his admission, he had slight twitchings of his muscles when in bed. He was not at all emaciated. He said he had been salivated for about three months, soon after he began his occupation of packing furs; but his gums were not tender, and he had no metallic taste in his mouth. A month before his admission he gave up his work. When he became a patient under Dr. Rees, I saw him, and his case was watched by Mr. Spurgin, one of my pupils. He could walk with assistance, but on standing or lying down he could not control his limbs, which trembled considerably. There were continued involuntary movements of his body and limbs, like those of chorea. He became much exhausted, owing to want of sleep; he perspired profusely. The urine was high-coloured, but otherwise natural. Twelve ounces of it did not yield any mercury. No treatment appeared to give him rest or relief. Chloroform arrested the spasmodic movements, but only while he was under its influence. In five days he passed his urine involuntarily. He became more quiet and slept a little at night. He had difficulty in swallowing; became gradually weaker and died, apparently from exhaustion, on the 24th December, a fortnight after his admission. On inspection, the body was well nourished; the muscles were firm and healthy. The brain and spinal cord were carefully examined by Dr. Wilks, and found to be quite healthy. The lungs, heart, liver, spleen and kidneys, were free from any morbid appearance, or any change to indicate a cause of death. I made a chemical analysis of the brain, liver, and kidney. Six ounces of each organ were dried, and one-half of the dried residue, treated with hydrochloric acid and water, as elsewhere described (page 229) gave, in 48 hours, on a small portion of copper gauze, a greyish white deposit, which yielded globules of metallic mercury by heat. The kidney yielded the largest sublimate; but the quantity obtained from each organ was small, and might be described as in microscopical traces. The globules from the brain and liver had an average size of 1-2600th of an inch; those from the kidney were larger. Dr. Whitley procured a portion of the fur similar to that which the man had been engaged in packing, and in a small quantity of this, a soluble salt of mercury was readily detected. The case which at first presented some difficulty in accounting for death, thus resolved itself into one of exhaustion as a result of chronic poisoning by mercury under somewhat unusual circumstances. It is probable that the man received the dust of the dried nitrate through the air which he breathed, as well as by contact with his mouth, nostrils, and skin. As other workpeople similarly engaged were not found to have suffered, this may have been a case of mercurial poisoning by idiosyncrasy.

Analysis.—When heated with dry or anhydrous carbonate of soda in a tube, the dry nitrate yields a sublimate of mercury. If heated alone, it is resolved into red oxide.

CHAPTER 20.

ON POISONING BY LEAD—SUGAR OF LEAD—SYMPTOMS—APPEARANCES AFTER DEATH—CHEMICAL ANALYSIS—LEAD IN ORGANIC MIXTURES—CARBONATE OR WHITE LEAD—CHRONIC POISONING—POISONING BY COPPER—BLUE VITRIOL. SYMPTOMS. APPEARANCES AFTER DEATH.—POISONING BY OTHER COMPOUNDS OF COPPER—CHEMICAL ANALYSIS. COPPER IN ORGANIC LIQUIDS—IN ARTICLES OF FOOD.

SUGAR OF LEAD. *Acetate of Lead.*—This is more frequently taken as a poison than any of the other salts, although cases of acute poisoning by lead in any form are not common. The substance is commonly met with in solid heavy crystalline masses, white, or of a brownish-white colour; it resembles loaf-sugar in appearance, and has often been mistaken for it. It has also a sweet taste, which is succeeded by an astringent or metallic taste. It is very soluble in water. Four parts of distilled water at 60° will dissolve one part; it is much more soluble at a boiling temperature.

Symptoms.—Acetate or sugar of lead is by no means an active poison, although it is popularly considered to possess a virulent action. In medical practice it has often been given in considerable doses without any serious effects resulting. Dr. Christison states that he has given it in divided doses to the amount of eighteen grains daily for eight or ten days without remarking any unpleasant symptom, except once or twice slight colic. When, however, the quantity taken has been from one to two ounces, the following symptoms have been observed: a burning pricking sensation in the throat, with dryness and thirst, vomiting and uneasiness at the pit of the stomach, sometimes followed by severe colic. The abdomen is tense, and the parietes have been occasionally drawn in. The pain is relieved by pressure, and has intermissions. There is generally constipation of the bowels. If any fæces are passed, they are commonly of a dark colour, indicative of the conversion of a portion of the lead into sulphide. The skin is cold, and there is great prostration of strength. When the case is protracted, the patient has been observed to suffer from cramp in the calves of the legs, pain in the insides of the thighs, numbness, and sometimes paralysis of the extremities. The affection of the nervous system is otherwise indicated by giddiness, torpor, and even coma. A well-marked blue line has been noticed round the margin of the gums, where they join the teeth.

A remarkable series of cases of poisoning by acetate of lead has been reported by Mr. Bancks, of Stourbridge. ('Lancet,' May 5, 1849, p. 478.) By some accident, about thirty pounds of this substance were mixed at a miller's with eighty sacks of flour, and the whole was made into bread by the bakers and supplied as usual to their customers. It seems that no fewer than five hundred persons were attacked with symptoms of poisoning after partaking of this bread. In a few days they complained of a sense of constriction in the throat and the pit of the stomach, violent crampy pains round the navel, rigidity of the abdominal muscles, a dragging pain in the loins, and cramp with paralysis of the lower extremities. There was obstinate constipation, and the urine was scanty and of a deep red colour. The pulse generally was slow and feeble; the countenance anxious and sunken, frequently of a peculiar livid hue; tongue flabby; gums marked by a deep blue line. The surface was cool, and there was a general arrest of the secretions. Sickness was not a uniform symptom, and even when it existed at first, it speedily subsided. The mental faculties were undisturbed. Not one of the cases proved fatal, but among the more aggravated, there was great prostration, with collapse, livid countenance, universal cramps, numbness, and other alarming symptoms. After apparent convalescence, some of the symptoms returned in a more aggravated form without any obvious cause, and for a long time the patients were out of health. Inflammation was not observed. Purgative medicines were found most effectual in the treatment. The quantity of acetate of lead taken by each person could not be determined, as, on analysis, the samples of bread were found to be unequally impregnated with the poison.

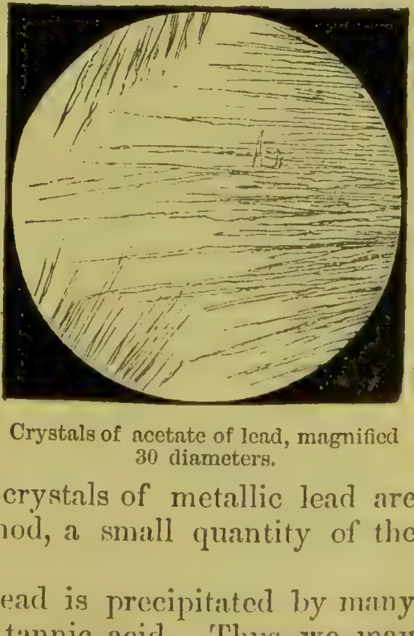
Even when the patient recovers from the first symptoms, the secondary effects often last for a considerable time. Mr. Gorringe has recorded the cases of two girls, each of whom swallowed an ounce of the acetate of lead by mistake. Soon afterwards they felt a burning pain in the mouth, throat, and stomach, and in a quarter of an hour they vomited freely: in half an hour, there was severe pain in the bowels, with purging. Under treatment recovery took place. ('Prov. Med. Journ.' April, 1846.) After the lapse of a year, they both suffered from severe pain in the pit of the stomach, which was tender on pressure. Nothing could be retained on the stomach; and there was a choking sensation in the throat, with other constitutional symptoms. Paralysis and other symptoms of nervous disorder are, however, by no means necessary consequences. A girl who had swallowed sixty grains of acetate of lead, and had suffered severely from the primary symptoms, recovered in about three weeks without any paralysis or other disorder affecting the muscular system. ('Lancet,' April 4, 1846, p. 384.) This lead-palsy appears to be a more common consequence of chronic poisoning; *i. e.* of small doses taken at intervals.

Appearances.—In one acute case related by Dr. Kerchhoffs, the mucous membrane of the stomach was found removed in several places, especially near the intestinal opening; and most of the intestines were in a state of high inflammation. A trial for murder by this substance took place at the Central Criminal Court, in November 1843 (*Reg.* v. *Edwards*). The stomach and intestines are stated to have been found inflamed, and there were dark spots on the former. In animals, according to Dr. Mitscherlich, when the dose is large, the mucous coat of the stomach is attacked and corroded; this change appears to be purely chemical, and takes place in all parts of the body with which the salt of lead comes in contact. If given in a small dose, it is decomposed by the gastric secretions, and exerts no corrosive power on the mucous membrane. When the acetate of lead was given in a state of albuminate dissolved in acetic acid, death took place with great rapidity; but on inspection, the stomach was not found corroded. This corrosive action belongs to the neutral salt, and is not manifested when the dose is small, or when the poison is combined with an acid.

Quantity required to destroy Life.—Nothing is actually known concerning the *fatal dose* of sugar of lead. The facts already detailed show that it may be taken in comparatively large quantity without producing serious effects. Thirty or forty grains have been given daily, in divided doses, without injury. The following additional cases, in some of which recovery took place under disadvantageous circumstances, prove that the acetate of lead is far from being a virulent poison. Dr. Iliff met with an instance in which *an ounce* was swallowed in solution: the symptoms were pain in the abdomen resembling colic, vomiting, rigidity, and numbness. It was three hours before any remedies were used, and five hours before the stomach-pump was employed; but the person recovered. In the second case, also, an ounce was swallowed: sulphate of magnesia was freely exhibited, and the stomach-pump was used. On the following morning there was slight excoriation of the gums, which were white, with a sensation of heat in the throat: the bowels were relaxed, probably from the effect of the medicine. The day following, there were pains in the legs and thighs, with restlessness and thirst. In a week the woman perfectly recovered. In a case which occurred to Dr. Alderson, a man swallowed an ounce of the acetate of lead in a drunken fit. There was violent vomiting, and the man recovered.

Chemical Analysis. Acetate of Lead as a Solid.—1. If a portion of the powder is heated in a small reduction-tube, it melts, then becomes solid: again melts, acquiring a dark colour, and gives off vapours of acetic acid; a black mass is left in the tube, consisting of carbon and reduced metallic lead. No sublimate is formed. If heated on mica, yellow oxide of lead with reduced metal remains. 2. It is very soluble in water, even when cold; spring water is turned milky by it, from the presence of carbonic acid and sulphates. 3. A small portion of the powder dropped into a saucer containing a solution of iodide of potassium acquires a fine yellow colour. 4. When dropped into caustic potash it remains white. 5. Into sulphuretted hydrogen water or sulphide of ammonium, it is turned black, in which respect it resembles the white salts of some other metals. 6. When the powder is boiled in a tube with diluted sulphuric acid, acetic acid, known by its odour and volatility, escapes. All these properties taken together, prove that the salt is the acetate of lead.

Acetate of Lead in Solution.—If acetate of lead is presented in a state of solution, or if the salt is dissolved in water for the purpose of making further examination, we should note the following points. 1. A small quantity, slowly evaporated on a glass slide, will give slender white prismatic crystals, which are turned yellow by iodide of potassium, and black by sulphide of ammonium. The solution is said to be neutral; but I have found the common acetate of lead to have at the same time both an acid and (with rose paper) an alkaline reaction, *i. e.* reddening litmus paper, and turning rose-paper green, a circumstance which might create some embarrassment in an analysis. 2. *Diluted sulphuric acid* produces an abundant white precipitate, insoluble in nitric acid, but soluble in hydrochloric acid and in a large excess of potash. 3. It is precipitated of a bright yellow colour by the *Iodide of potassium*; the yellow iodide of lead is soluble in potash, forming a colourless solution. It is also dissolved by concentrated hydrochloric acid. 4. *Sulphide of ammonium* or sulphuretted hydrogen gas, produces a deep black precipitate, even when less than the 100,000th part of the salt is dissolved. 5. Place a few drops of the solution on clean platinum foil, acidulate it with acetic acid, then apply through the solution, to the surface of the platinum, a thin polished slip of zinc:—crystals of metallic lead are instantly deposited on the zinc: by this method, a small quantity of the metal may be detected and collected.



Crystals of acetate of lead, magnified 30 diameters.

Lead in Organic Mixtures.—The acetate of lead is precipitated by many organic principles, especially by albumen and tannic acid. Thus, we may have to analyze either an organic liquid containing lead, or a solid precipitate consisting of mucus or mucous membrane, intimately united to oxide of lead. The liquid should be filtered and examined by a trial test, *i. e.* either by adding to a portion, sulphuric acid, or by exposing bibulous paper, dipped into the suspected liquid, to a free current of sulphuretted hydrogen gas. If the paper is not stained brown, there is no perceptible quantity of lead dissolved;—if it is stained brown, we dilute the liquid if necessary, in order to destroy its viscidity, and pass into it a current of washed sulphuretted hydrogen gas until all the chemical action has ceased. The black sulphuret of lead should be collected on a filter, washed and dried, then boiled for a quarter of an hour in a mixture of one part of nitric acid, diluted with four parts of water. This has the effect of transforming it, at least in part, to nitrate of lead soluble in water. This liquid, when filtered, may be evaporated to dryness, and the residue dissolved in water, or it may be at once cautiously neutralized by potash (free from lead) or by ammonia, and the tests added. If the quantity is too small for the application of all the tests, we may add sulphuric acid; should a white precipitate be formed, soluble in potash (free from oxide of lead), and this alkaline solution be again turned black by sulphide of ammonium, this is sufficient evidence of the presence of lead. Should there be no lead dissolved, we must decompose the solid and insoluble matters in nitric acid slightly diluted, at a boiling temperature, filter, and test the filtered liquid, previously neutralized; or we may evaporate to dryness, destroy the organic matter by heat and redissolve the residue in nitric acid for testing.

In the Tissues.—The organic matter, such as a part of the liver or other organ, should be dried and incinerated in a porcelain vessel. The ash should be heated with a small quantity of strong nitric acid, and then evaporated to dryness. The dry residue should be digested in a small quantity of distilled water (free from lead), filtered, and after it has been slightly acidulated with nitric acid, a current of washed sulphuretted hydrogen gas should be passed into it. The production of a brown colour or a brown precipitate indicates the presence of lead. Lead may thus be detected in the dry residue of urine and of spring or river water.

GOULARD'S EXTRACT. *Subacetate of Lead. Symptoms and Effects.*—This substance has caused death in at least four instances,—one in France and three in England. Dr. Aldis describes the case of a woman, æt. 21, who swallowed about three-quarters of a pint of Goulard's extract of lead (strength not stated), having begun with small doses. When first seen she was in great agony. There was severe colicky pain in the abdomen which she rubbed frequently, and the muscles of the belly were drawn inwards. The pulse was feeble, there was trembling of the hands, and she was in constant motion with her body from severe suffering. There was heat in the throat and abdomen with intense thirst, and a desire to vomit, but there was no vomiting or purging. A dose of sulphate of magnesia produced vomiting and she recovered; but there remained obstinate constipation of the bowels. ('Lancet,' Jan. 14, 1860.)

GOULARD WATER is nothing more than a mixture of one drachm and a half of this solution to a pint of water.

WHITE LEAD. *Carbonate of Lead. Symptoms.*—A case of poisoning by the carbonate of lead, was reported, in October 1844, to the Westminster Medical Society, by Dr. Snow. A child aged five years ate a portion not so large as a marble, ground up with oil. For three days he merely suffered from pain in the abdomen, and costiveness. On the third night, the child became rapidly worse, and there was vomiting. He died ninety hours after taking the poison, having passed some offensive motions of a greenish-black colour (probably from admixture with sulphide of lead) before he died. The mucous membrane of the stomach was much inflamed, and of a dark-red colour throughout. Lead could not be detected in the contents or tissues of the stomach, or in the matter vomited. It is remarkable that in this case so small a quantity should have proved fatal without exciting any marked symptoms of irritation in the first instance. A young man, æt. 20, was recommended to take chalk on account of acidity and heartburn. He took by mistake a piece of carbonate of lead, and ate about five or six drachms of it. After a few hours he complained of violent burning pains in the stomach, with vomiting. Twenty-fours afterwards, when first seen, he suffered from violent pain, particularly in the pit of the stomach and at the navel. His face was red and swollen, his eyes shining and prominent; his tongue and mouth dry and very red; abdomen distended and extremely sensitive to superficial pressure, whilst stronger pressure alleviated the pain; great thirst; the bowels were constipated. Sulphate of magnesia dissolved in water, with one scruple of tincture of opium, was given to him, and larger doses of the same salt to be repeated with an oily emulsion, by which means the patient soon recovered. ('Casper's Wochenschrift,' No. 36, 1844.) Most of the cases of poisoning by carbonate of lead have been of a chronic character.

Chronic Poisoning. Colica pictonum, or *Painter's Colic*, may be considered as the chronic form of poisoning by carbonate of lead. It is often difficult to trace the cause, so slowly and insidiously are the effects manifested. In some instances the poison is received through the lungs, or skin, or by the saliva, although no physical or chemical evidence of this mode of introduction can be obtained. In another work ('ON POISONS,' 2nd ed., p. 485) I have referred to cases in which colic and paralysis have occurred in persons who had slept in newly painted rooms. Dr. Alderson mentions several instances of this kind. ('Lancet,' Oct. 30, 1852, p. 391.) I have myself suffered from a severe attack of colic as a result of sitting in a room for a few hours a day in which a large surface of canvas for an oil-painting had been covered with white lead and drying oil. The late Mr. J. Lizars, of Edinburgh, communicated to me the following case. A military officer, æt. 50, fond of painting in oil-colours, worked for some time in a room eight feet square which had a arge stove in it. He was attacked with wrist-drop (paralysis) in December, 855, and soon afterwards with paralysis in both legs. It appears that his servant always ground his colours, mixed them, and cleaned his brushes. He had an attack some years before; but from this, by laying aside oil-painting, he completely recovered. In these instances the emanations of lead must have been received through the lungs. Doubtless chemists might be found who would undertake to prove, by ingeniously devised experiments, that there ould be no lead in the air of the room; and coupling their results with the act that few artists are known to suffer from such symptoms, would contend hat lead was not the cause. The symptoms, however, were of the character peculiar to lead-poisoning, and as they disappeared on the removal of the patient to another atmosphere, there could be no doubt about the cause. These insidious effects of lead should be borne in mind by those who deny hat any noxious emanations can proceed from arsenical papers in inhabited ooms, merely because the greater number of persons who live in them do not uffer, and because some chemists have affirmed that they could detect no rsenic in a volatile state in the atmosphere of the room. Among white-lead manufacturers the carbonate finds its way into the system either by the skin, he lungs, mouth and nostrils, or all these channels together;—it is diffused n a fine powder through the atmosphere, and thus enters into the lungs. It as been remarked in France, that, in manufactories where the powder was round dry, not only have the labourers suffered, but horses, dogs, and even ats have died from its effects: the rats have been affected with paralysis in their hind legs. Since the practice has arisen of grinding the carbonate of lead in water, cases of colica pictonum have not been so numerous.

Men employed in the manufacture of pottery or glazed cards are liable to attacks of this kind. There are numerous other cases in which lead, or its preparations, by mere contact with the skin, have been known to produce the usual results of lead-poisoning. The late Mr. Scanlan communicated to me a case in which an infant was paralyzed by reason of its having been, every morning, washed with water containing a finely diffused oxide and carbonate of lead. Dr. Todd has described the case of a man in King's College Hospital who suffered from lead-palsy : he had been a potman, and the palsy was attributed to the constant handling of and cleaning of pewter pots. ('Med. Gaz.' vol. 48, p. 1047. For another case, see 'Lancet,' Jan. 21, 1860, p. 60.) The mere handling of lead or its oxides, is therefore sufficient to produce all the effects of chronic poisoning. I have been informed of a case in which a tea-dealer was seized with symptoms of lead-poisoning, and the cause remained long unsuspected, until he admitted that, in the course of his trade, he had the idle habit of often placing pieces of tea-lead in his mouth, and crushing the metal between his teeth. One cause of lead-palsy among infants may be the use of farinaceous food wrapped in lead-foil having a thinly tinned surface. I have found such infants' food to be strongly impregnated on the outside with carbonate of lead. ('On Poisons,' 2nd ed. p. 505.) Snuff and tobacco, chocolate, and other substances in ordinary use, are frequently wrapped in spurious tin-foil. If the articles are kept in a damp place, they may thus become impregnated with carbonate of lead. In a case which was under Dr. Rees at Guy's Hospital, in January 1861, no source of lead could be traced, although the symptoms were those of chronic lead-poisoning, and lead was found in the urine. Cosmetics and hair-dyes containing preparations of lead, may also produce dangerous effects. I have met with an instance in which paralysis of the muscles on one side of the neck arose from the imprudent use of a hair-dye containing litharge. Mr. Lacy has pointed out the injury to health which is likely to follow the use of white lead as a cosmetic by actors. The glazed white leather lining of hats is strongly impregnated with carbonate of lead, which may penetrate the body by the perspiring skin. Other facts connected with this form of lead-poisoning, will be found in the 'Medical Times and Gazette,' Aug. 1852, p. 223 ; 'Ann. d'Hyg.,' 1859, vol. 1, pp. 95 and 296: also 'Ann. d'Hyg.,' 1861, vol. 1, pp. 342 and 389.

Symptoms and Appearances.—The symptoms of chronic poisoning by lead are well marked. There is at first pain with a sense of sinking commonly in or about the region of the navel (the seat of the colon). Next to pain there is obstinate constipation, retraction of the abdominal parietes, loss of appetite, thirst, fœtid odour of the breath, and general emaciation, with paralysis of a peculiar kind affecting the extensor muscles, and causing a dropping of the wrist, or showing itself in a general paralysis of the limbs. The skin acquires a sallow or earthy colour, generally well marked in the face, and the patient experiences a sweetish, styptic, or astringent taste in the mouth. A symptom of a peculiar nature was first pointed out by the late Dr. Burton ('Med. Gaz.' vol. 25, p. 687), namely, a *blueness* of the edges of the *gums*, where these join the bodies of the teeth: the teeth are of a brownish colour. Dr. Chambers affirms that this blue line on the gums is an early consequence of lead-poisoning in any form, and is a distinguishing sign of lead-colic. A gas engineer, who had worked for eighteen years in his trade, had during this time used a quantity of red and white lead for various purposes. It was, however, only within the last eighteen months of his work that he had suffered from the usual symptoms of lead-poisoning. ('Lancet,' Jan. 21, 1860, p. 60.) It is worthy of note, that although this person had been so many years exposed to the causes of lead-disease, he did not suffer from any symptoms until the latter part of the time. A blue mark round the edges of the gums has been noticed in some cases of poisoning by mercurial preparations; and it is possible that in an advanced stage of chronic poisoning by lead, it may be absent—as where, for example, the individual has ceased to expose himself to emanations of lead (see case by Mr. Fletcher, 'Med. Times,' Feb. 14, 1846, p. 395). Many facts tend to show that in general it is an early symptom. Chronic poisoning by lead often kills the patient; after death the large and small intestines have been found much contracted, and their coats thickened. These changes have been especially observed in the colon.

The most frequent cause of chronic lead-poisoning is the use of water kept in leaden cisterns or pipes, or the careless employment of white or red lead as a cement for pipes. It has been recently suggested that leaden pipes and surfaces may be protected from the chemical action of water, and water preserved from a poisonous contamination, by a very simple expedient. Lead which has been immersed for a short time in a hot solution of sulphide of sodium, acquires a protective coating of sulphide scarcely visible to the eye. A bar of lead thus prepared and well dried, was placed in water which was known to exert a chemical action on the metal in a few hours, and after four weeks' immersion, there was no lead in the water which could be detected by sulphuretted hydrogen. For an instructive series of cases showing the effects of water poisoned with lead, I must refer the reader to a paper, by Dr. de Mussy, published in the 'Dublin Quarterly Journal' for May 1849; also 'Medical Gazette,' vol. 44, p. 260. These cases occurred at Claremont, among the members of the ex-Royal Family of France. The effects were traced to the use of pure water which had acquired an impregnation of lead by contact with that metal, in the proportion of one grain to the imperial gallon. Thirteen out of hirty-eight persons were affected, and to such a degree, that the nails of the toes nd fingers acquired a bluish discolouration. The children of the family did not uffer. This is perhaps the smallest quantity of lead in water accurately recorded o have produced the effects of poisoning. No symptoms appeared until after he water had been in use for a period of from five to seven months, and more han half of those who used the water, escaped any ill effects. According to Mr. Herapath, the symptoms of lead-poisoning have been produced in a comunity by so small a quantity as one ninth of a grain of lead in a gallon; and r. J. Smith, of Aberdeen, concludes from his investigations that the limit of anifestly deleterious action, would seem to be somewhere between one tenth nd one twentieth of a grain in a gallon (Dr. Penny, 'Report on Loch Katrine Water,' p. 107). Waters collected from lead-mining districts generally conain lead either in suspension or in solution. In one of these proposed to be pplied to Wrexham in North Wales, I found the proportion of lead to be e eleventh of a grain in a gallon, a quantity which might prove noxious to me portion of a town population, as a result of long-continued use. A edical officer of health deposed before a Committee of the House of Lords, May 1864, that there was less than one fourteenth of a grain of lead in a llon, and that this proportion, if present, would do no injury, while any oportion below one twelfth of a grain would be noxious, although the data on which this sharply defined distinction was based, were not made public. it has been resolved that this plumbeous water shall be supplied to, and ed by, a population of 7,000 persons, an opportunity will no doubt present elf of testing on a large scale the effects of minute quantities of lead on system. A water which acts chemically on the metal may soon cease to by reason of a hard deposit taking place in the interior of the pipes, and it en sheathes the metal from further chemical action. When the water, before tering the pipes, is already provided with so much lead that it easily admits of detection in a pint, it will be always more or less impregnated with salts of this metal, and therefore more or less noxious to health. A safe sanitary rule would be that suggested by Dr. Penny. All lead-contamination is objectionable, and no degree of it can be considered safe. Lead is an accumulative poison, and affects some persons powerfully in the smallest quantities.

In 1850, it was proposed to refine sugar by the use of a salt of lead. It was found that the proportion of lead-salt contained in sugar refined by this process varied from two tenths to four tenths of a grain in four pounds. The Commissioners of Inland Revenue, considering that this small quantity might affect the public health, referred the consideration of the question to the late Dr. Pereira, Dr. Carpenter, and myself. We came to the conclusion that even this degree of contamination of such a universal article of food as sugar, was objectionable, and that such a process of manufacture should be as far as possible prohibited.

For an account of the various conditions under which water is liable to be poisoned with lead, and the effects produced by the use of such water, I must refer the reader to my work 'ON POISONS,' p. 506.

Analysis.—Carbonate of lead is a solid white powder, insoluble in water, and immediately blackened by sulphuretted hydrogen or sulphide of ammonium. 1. When heated on platinum, it leaves a residue of yellow or orange-coloured oxide of lead, soluble in nitric acid. 2. The carbonate is easily dissolved with effervescence, by diluted nitric acid—a fact which shows that it contains carbonic acid. The oxide of lead, combined with nitric acid, may be readily detected in the filtered solution by the tests already mentioned. This salt of lead is sometimes contained in small proportion in loaf sugar, owing to the moulds in which the loaf is set to crystallize being painted with white lead, and a portion being thus mechanically taken up. This is a noxious practice, and ought to be prohibited. Water which is suspected to contain a small quantity of this compound, may be tested for lead by the process described for the tissues at p. 238. At least an Imperial pint should be made the subject of experiment.

OXIDES OF LEAD.—The yellow oxide (massicot), and the brown oxide (peroxide), are but little known except to chemists. *Litharge* and minium or *red lead* are, however, much employed in the arts, and have sometimes given rise to accidental poisoning. In October, 1849, a woman who had swallowed two and a quarter ounces of the red oxide of lead, was admitted into Guy's Hospital. No symptoms appeared for nine hours. There was then colicky pain, with urgent vomiting, followed by head-ache and general tenderness of the abdomen. She entirely recovered in about twelve days. ('Guy's Hospital Reports,' October, 1850, p. 209.)

Liquids used for culinary or dietetic purposes, especially if they contain a free *acid*, are liable to become impregnated with oxide of lead, derived from the glaze of the vessel in which they are kept, and thus form poisonous salts. If vinegar is used, acetate of lead may result. Litharge-glaze is also easily dissolved by alkaline or *fatty* substances. The eating of dripping, or the fat of meat baked in a newly-glazed vessel, has been known to give rise to a slight attack of colic; while the symptoms were referred by the person to some substance mixed with the food. (For cases of this kind see the 'Medical Gazette,' vol. 47, page 659; also 'Lancet,' 1860, vol. 1, p. 962.) I am indebted to Mr. Procter, of York, for the particulars of a case of some novelty, in reference to the contamination of food with lead. In July, 1852, four men partook of rhubarb-pie and milk for supper; shortly afterwards they were all seized with violent vomiting and intense colic. A portion of the vomited matters and food was examined by Mr. Procter, and lead was detected in them. The only source to which the lead could be traced, was the glaze of the pans in which the milk was kept. *Cider* is sometimes poisoned with lead owing to the use of leaden vessels or pipes in its manufacture. An instance of the fatal effects of cider so poisoned, is reported to have occurred in Worcestershire in January, 1864. Lead pipes are largely used by publicans for the supply of beer. It is possible, therefore, if the beer is acid, and is allowed to remain some time in the pipe, it may acquire an impregnation of lead, which might give rise to colic and other unpleasant symptoms. When liquids of this kind are impregnated with oxide of lead, the fact is immediately known by their being turned of a brown colour by sulphuretted hydrogen. All newly-glazed vessels yield traces of lead, more or less, on boiling in them vinegar, pure acetic acid, or a solution of pure potash. In this manner the poisonous nature of the glaze may be tested:—the oxide of lead being dissolved either by the acid or the alkali. I have found common acetic acid itself containing, as impurity, two per cent. of acetate of lead. I have also found lead in citric and tartaric acids, and in salts which have been crystallized in leaden pans. Litharge was formerly much used to remove the acidity of sour *wine*, and to convey a sweet taste. Acetate of lead, or some other vegetable salt of the metal, is in these cases formed; and the use of such wine may be productive of alarming symptoms. Many years since a fatal epidemic colic prevailed in Paris, owing to this cause: the adulteration was discovered by Fourcroy, and it was immediately suppressed. Wine thus poisoned is known by its being blackened by sulphuretted hydrogen.

Snuff has been adulterated with red lead in order to improve its colour! wo instances of chronic poisoning by lead have come under my notice, as a esult of the presence of oxide of lead in snuff. One sample contained the xide in large proportion. This noxious adulteration has frequently given se to paralysis and other forms of lead-disease. ('Med. Gaz.,' vol. 32, 138; also 'Ann. d'Hygiène,' 1831, vol. 2, p. 197; and 'Lancet,' Jan. 21, 860, p. 60.)

Dr. Sonnenkalb, of Leipsic, considers that snuff commonly acquires an mpregnation of lead, by reason of the coverings of lead in which it is packed. e has collected nineteen cases of this form of chronic poisoning: in fourteen these there was paralysis, and in five there were symptoms of gastric disrbance. The arms were most commonly affected with paralysis in the tensor muscles, which wasted. In twelve cases there was a blue colour of e gums. All suffered from colicky pains and constipation. The poisoned uff had been used for a period of from six months to twenty years: and on aving it off, the patients improved rapidly, and eventually recovered.

PREPARATIONS OF COPPER.

All the salts of copper are poisonous. The two most commonly known in mmerce are the SULPHATE OR BLUE VITRIOL, and the SUBACETATE OR VERDIs. The former has been frequently taken and administered in large doses the purpose of suicide and in attempts at murder. In the latter case the empt has been immediately discovered, owing to the strong metallic taste ssessed by the salt. This would in general render it impossible that the son should be taken unknowingly. With the exception of these salts, soning by copper is usually the accidental result of the common employnt of this metal for culinary purposes. There is one copper salt—the SENITE (Scheele's Green)—which chiefly owes its poisonous properties to enic. This has been elsewhere considered (page 217).

Blue Vitriol. *Sulphate of Copper. Symptoms.*—Sulphate of copper has been frequently given for the purpose of procuring abortion. In doses of half an ounce and upwards, it acts as a powerful irritant on adults, and a much smaller quantity would suffice to destroy infants or children. The salt speedily causes vomiting of the most violent kind; this sometimes expels the poison from the stomach, and the person recovers. The *vomited* matters are remarkable for being generally of a *blue* or *green* colour; and broken crystals of blue vitriol were discovered in them, in a case in which the poison was taken in a loosely pulverulent state. If the green colour of the vomited liquids is owing to altered bile, it will not acquire a blue tint on adding to a portion of the green liquid a strong solution of ammonia; but if it be caused by a salt of copper, this change of colour will serve to indicate the fact. There is head-ache, pain in the abdomen, with purging; the pain is of a colicky character; and in aggravated cases, there are spasms of the extremities and convulsions. Dr. Percival met with an instance in which violent convulsions were produced in a young female by two drachms of the sulphate of copper. Paralysis, insensibility, and even tetanus, have preceded death, when the poison was administered to animals. Among the symptoms casually met with in the human subject, may be mentioned jaundice. This has been observed to attend poisoning by the sulphate, as well as by Scheele's green. The medicinal dose of sulphate of copper as an emetic, is from five to fifteen grains, and as a tonic from one to three or four grains.

There are but few instances in which this poison has proved fatal in the human subject. In 1836 a girl, sixteen months old, put some pieces of *Blue stone* (sulphate of copper), which were given to her to play with, into her mouth. In a quarter of an hour the child vomited a bluish-green coloured matter, with pieces of sulphate of copper in it; the skin was alternately cold and hot, but there were neither purging nor convulsions. The child died in *four hours*, and was insensible before death. ('Medical Gazette,' vol. 18, p. 742.) Unfortunately no inspection of the body was made; and yet, in the event of murder being committed by the administration of this substance, it will be somewhat unreasonably expected that medical witnesses should be fully acquainted with the appearances produced by it in the stomach and bowels.

Appearances.—In poisoning by the salts of copper, the mucous membrane of the stomach and intestines has been found more or less thickened and inflamed in the few fatal cases which have been hitherto examined: the membrane has been also found eroded and softened in poisoning by verdigris. The gullet has presented an inflammatory appearance. In a case of poisoning by verdigris, quoted by Orfila, the stomach was inflamed and thickened, especially towards the intestinal opening, the orifice of which, from the general thickening, was almost obliterated. The small intestines were throughout inflamed, and perforation had taken place, so that part of the green liquid was effused into the abdomen. The large intestines were distended in some parts, and contracted in others, and the rectum was ulcerated on its inner surface. ('Toxicologie,' vol. 1, p. 623.) The lining membrane of the alimentary canal has been found throughout of a deep green colour, owing to small particles of verdigris adhering to it. It has been said that this is an uncertain character of poisoning by copper; since a morbid state of the bile often gives a similar colour to the mucous membrane of the stomach and duodenum. This objection cannot apply when the green colour is found in the gullet, and throughout the intestines; and, under any circumstances, the evidence from the presence of a green colour would amount to nothing in the judgment of a prudent witness, unless copper were freely detected in the parts so coloured. It is well to remember that the green stain, if due to copper, will be turned blue by ammonia.

VERDIGRIS. *Subacetate of Copper.*—This salt produces *symptoms* somewhat similar to those caused by the sulphate. There is a strong styptic metallic taste, with a sense of constriction in the throat, followed by severe colicky pains, vomiting of a green-coloured liquid, and purging, with violent straining (tenesmus). In a case reported by Pyl, a woman who swallowed *two ounces* of verdigris died in three days: in addition to the symptoms above described, there were convulsions and paralysis before death. Niemann relates that a female, aged twenty-four, swallowed *half an ounce* of verdigris, and died under symptoms of severe irritation of the stomach in sixty hours. ('Taschenbuch,' p. 458.) In consequence of the great uncertainty of its operation, subacetate of copper is not employed internally.

The SUBCHLORIDE and CARBONATE are also irritant poisons.

Chemical Analysis of the Salts of Copper.—The salts of copper are generally known by their colour; whether in the solid state, or in solution, they are either blue or green. The salts of one other metal are also of a green colour, namely nickel; but there are striking chemical differences between the salts of this metal and those of copper. There are *three* very *soluble* salts of copper; two of these are blue, the sulphate and nitrate, and one green, the chloride. The solutions of the cupreous salts have generally an acid reaction. The salt should be dissolved in water, diluted, and the following tests may then be applied.

Tests.—1. *Solution of ammonia*: this gives, in a solution of copper, a bluish-white precipitate, which is soluble in an excess of the test, forming a deep violet-blue liquid. 2. *Ferrocyanide of potassium* gives a rich claret-red precipitate; if the quantity of copper is small, the liquid acquires merely a light-red colour; if large, the precipitate is of a deep red-brown colour, and of a gelatinous consistency. The ferrocyanide of potassium will act on the violet-blue solution produced by ammonia, provided it is diluted, and an acid is added (sulphuric) to neutralize the ammonia. One portion of the liquid may thus be tried by the two tests. 3. *Sulphuretted hydrogen gas*, or sulphide of ammonium, gives a deep chocolate-brown precipitate, even in an acid solution; or if the copper is in small proportion, merely a light-brown colour. 4. A slip of *polished iron* (a common needle) suspended by a thread in the liquid slightly acidulated with sulphuric acid is speedily coated with a layer of copper, even when the salt is in very small proportion. If the needle is left for some days in the liquid, the iron will be slowly removed, and a hollow cylinder of metallic copper will remain. This may be dissolved in diluted nitric acid, and tested with the foregoing tests; or the iron coated with copper, may be at once immersed in ammonia and exposed to air. The liquid then becomes slowly blue. Half a grain of sulphate of copper dissolved in sixteen ounces of water may be thus easily detected. It was long since proposed by Orfila to substitute phosphorus for polished iron. This substance most effectually separates metallic copper from its salts, even when they are dissolved in organic liquids. 5. *The Galvanic Test.*—If a few drops of the copper solution are placed on platinum-foil, slightly acidulated with a diluted acid, and the platinum is then touched through the solution with a thin slip of zinc-foil, metallic copper, of its well-known red colour, is immediately deposited on the platinum. When the quantity of copper is small, there is merely a brown stain; but a blue liquid is formed by pouring on it ammonia, and exposing it to air. A coil of fine platinum and zinc wire may be substituted for the foil.

Copper in Organic Liquids.—The oxide of copper is liable to be precipitated by certain organic principles, *e. g.* albumen, fibrin, and mucous membrane: but some of these organic compounds are easily dissolved by acids, or even by an excess of the solution of cupreous salt. A portion at least of the salt of copper is, therefore, commonly held dissolved. In such cases there is one peculiar character possessed by these liquids, *i. e.* they have a decidedly *green colour* even when the copper salt is in a far less than poisonous proportion. The sulphate of copper, used in medicine and chemistry, sometimes contains traces of arsenic. About ten grains of the crystallized sulphate will be sufficient to yield evidence of the presence of this poison. When the sulphate has been given as an emetic, traces of arsenic may be found in the contents of the stomach or in the matters vomited. A polished needle or fine iron wire may be used as a trial-test for the presence of the salts of copper. If in large quantity, the copper may be precipitated by sulphuretted hydrogen, the sulphide collected, dried, and converted into a soluble sulphate by the action of strong nitric acid. If in small quantity, the following is the most expeditious method of obtaining copper from any organic liquid which contains a soluble poisonous salt of this metal. Having filtered the liquid, let a portion of it be placed in a clean platinum capsule or crucible. A few drops of diluted sulphuric acid may be added, and a slip of zinc foil introduced. Wherever the platinum is touched by the zinc, metallic copper is deposited; and after having in this way coated the platinum capsule, the surplus liquid may be poured off and the capsule well washed out. The copper is then dissolved in nitric acid, and the tests may be applied after the excess of acid has been driven off by heat.

In the Tissues.—Dry and incinerate the organic matter. Digest the residuary ash in pure hydrochloric acid by heat, and then evaporate nearly to dryness. The residue may be dissolved in a small quantity of water, and a polished needle immersed for some hours. The metallic deposit, if any, on the needle, may be recognized as copper, either by its colour or by the action of ammonia.

Copper in Articles of Food.—The medico-legal history of poisoning by copper would be incomplete without some remarks on the action of certain articles of food on this metal, when it is used for culinary purposes. This is not an unfrequent form of accidental poisoning. The symptoms rarely appear until after the lapse of three or four hours. There is commonly nausea, with colicky pains and cramps in the limbs. It results from the experiments of Falconer and others, that metallic copper undergoes no change by contact with *water*, unless air is present, when a hydrated carbonate, mixed with oxide of copper, is formed. If the water contains any acid such as vinegar, or common salt, or if there is oily or fatty matter in contact with the metal, then the copper is more rapidly oxidized, and the liquor or fat acquires a green colour. If the copper vessel is kept perfectly clean, and the food prepared in it, is allowed to cool in other vessels, there is not much risk of its acquiring a poisonous impregnation: nevertheless, no acid, saline, fatty, or oily liquid should be prepared as an article of food in a copper vessel. (See 'Ann. d'Hyg.' 1832, vol. 1, p. 102.) Under the influence of heat and air, a portion of copper becomes dissolved, and the oily or other liquid acquires a green colour. The preparation of fruits, such as preserves, in copper vessels, is necessarily attended with some risk; for, on cooling, a green crust is apt to form on the copper, just above the surface where the air and acid liquid meet. Some liquids while boiling, appear to be but little liable to this impregnation: thus, coffee, beer, milk and tea, have been separately boiled for two hours together, in a clean copper vessel, without any portion of the metal being taken up by either of the liquids. (See 'Falconer, on the Poison of Copper,' 65, London, 1774, also 'Orfila,' vol. 1, p. 611.) Accidents of this kind are usually prevented by lining the copper vessel with tin; but in very large boilers, this plan is not always adopted—cleanliness alone is trusted to, and this, when properly observed, is a sufficient preventive. According to Paasch, of Berlin, many of the accidents attributed to this form of cupreous poisoning are really due to other causes. (Casper's 'Vierteljahrschrift,' 1852, B. i. H. i. S. 78.) It has been elsewhere stated that all the ordinary copper employed for culinary utensils, contains arsenic (page 92). In those cases in which the metal is converted into insoluble oxides or salts, by salts, acids or fat, the arsenic may be found in an insoluble form in the green incrustation produced. When copper thus forms an insoluble salt, I have not found any arsenic dissolved.

It has been stated that an impure alloy used by some of the lower class of dentists has been so largely composed of copper, as to affect the health of those who have used the plates for the support of artificial teeth. The acid and salts in the saliva facilitate the production of a poisonous salt of copper, and probably set free arsenic.

In the making of preserved *fruits* and vegetable *pickles*, the salts of copper (blue vitriol) are sometimes used for the purpose of giving a rich green colour. Many of the green pickles sold in shops are thus impregnated with the vegetable salts of this metal, to which they owe their bright grass-green colour. If the fruit or pickle is placed in a solution of ammonia, and copper is contained in it, the substance is speedily turned blue. The iron-test is, however, more delicate. A bright needle immersed in the pickle, or plunged into the solid, will be speedily coated with copper. The quantity of copper contained in such articles may not be sufficient to cause fatal effects; but serious symptoms of gastric irritation are sometimes produced, and in young persons these may assume an alarming character. (See 'Falconer,' 87.)

CHAPTER 21.

TARTAR EMETIC — SYMPTOMS — APPEARANCES — CHRONIC POISONING—CHEMICAL ANALYSIS—CHLORIDE OR BUTTER OF ANTIMONY—POISONING BY SULPHATE AND CHLORIDE OF ZINC—PREPARATIONS OF TIN—SILVER—GOLD—IRON—BISMUTH AND CHROMIUM—BICHROMATE OF POTASH—THALLIUM—IODINE.

TARTAR EMETIC. TARTARATED ANTIMONY. STIBIATED TARTAR.—*Symptoms and Effects.*—When this substance is taken in a poisonous dose, a strong metallic taste is perceived in the mouth during the act of swallowing. There is great heat and constriction of the throat, with difficulty of swallowing, violent burning pain in the region of the stomach, followed by incessant vomiting, profuse purging, faintness, and extreme depression. The pulse is small and rapid, sometimes imperceptible ; the skin cold, and covered with a clammy perspiration; and the respiration is painful. Should the case prove fatal, death may be preceded by giddiness, insensibility, great prostration of strength, and sometimes violent spasms of the muscles of the extremities, which may assume either a clonic or a tetanic character. Such are the symptoms in an acute case of poisoning by this substance.

The *quantity* actually required to destroy life is unknown. It will probably depend in some degree on whether active vomiting and purging have been excited or not; for these symptoms have not been present in all cases. Doses of from twenty grains to one ounce have been taken without destroying life, although alarming symptoms of irritation have followed. In one case, related by Orfila, a man, aged fifty, took forty grains of tartar emetic, and died in about four days. This was the only one out of five cases of poisoning by this substance quoted by Orfila which proved fatal. ('Orfila,' vol. 1, p. 480.) Dr. Beck mentions a case in which fifteen grains of tartar emetic in solution killed a child in a few weeks: vomiting and purging ensued, followed by convulsions and death. This case proves that a patient is not always saved by vomiting and purging: the fatal effects on such an occasion are probably due to rapid absorption. (See 'Medical Gazette,' vol. 44, p. 334.) Dr. Pollock has recorded a case in which an adult was killed in ten hours by a dose of one drachm, in spite of early and violent vomiting. ('Med. Gaz.' vol. 45, p. 801.) In two cases observed by Mr. Hartley, which will be presently described, *ten grains* killed each child in a few hours. A dose of four grains, however, has been known to produce alarming symptoms. Dr. Lambert, who reports this case in 'Casper's Wochenschrift,' states that this dose gave rise to violent pain in the abdomen, vomiting, and purging. The patient then fell into strong convulsions, which lasted half an hour. He became speechless, no pulse could be perceived, the skin was cold, and it was supposed that he was dead. Stimulating frictions and poultices were employed, and he slowly recovered in about fourteen days. This poison, administered in small doses, may occasion death by reason of its exerting a depressing influence on the action of the heart. Aged persons, or those who are debilitated by disease, may die under these circumstances from a medicinal dose or doses which would produce no injury to strong and healthy adults. The effects, however, should be clearly traced to the action of the poison, and not be owing to exhaustion as a result of disease. In February, 1853, Mr. Wakley referred to me, for examination, a case in which it was supposed that two doses of antimonial wine, equal to about *three grains* of tartar emetic, had caused the death of a man who was in a diseased condition, by its remote effects upon the heart. No trace of poison was found in the stomach or tissues; there were no symptoms to indicate poisoning, and under these circumstances, death could not be reasonably attributed to the medicine. The man died in about twenty hours, probably from exhaustion of the vital powers as a result of disease, and not from the action of this substance.

In a case reported by Mr. Freer, of Stourbridge, a man, æt. 28, swallowed *two drachms* of tartar emetic by mistake for Epsom salts, and recovered from its effects. An hour after the poison had been taken he was found in the following state:—his pulse imperceptible; tongue dry and red; countenance cold and livid, bathed with clammy perspiration, and indicative of great suffering; violent pain in the stomach and over the whole of the abdomen, with constant spasmodic contraction of the muscles, particularly of the abdomen and arms. The fingers were firmly contracted, and the muscles quite rigid. He vomited only once, about half an hour after he had swallowed the poison, and after this, he had constant involuntary aqueous purging. An emetic of mustard and salt was given to him, and this produced violent vomiting of bilious matter. Green tea, brandy, and decoction of oak-bark were freely given. The cramps, vomitings, and aqueous purging continued for six hours. The symptoms then became mitigated, and he gradually recovered, suffering chiefly from profuse night perspirations. ('Lancet,' May 22nd, 1847, 535.) This case is remarkable for the anomalous character of the symptoms, as, in the absence of active vomiting, an emetic was actually required to be given, and also for the recovery of the individual after a large dose of the poison. In the 'Association Medical Journal' for April 1, 1853, at page 281, will be found reported a case in which a physician took half an ounce of tartar emetic by mistake for Rochelle salts. Vomiting did not come on for half an hour; but under good medical treatment, he recovered in a few days. In another case fifty-five grains caused the death of an adult in sixteen hours. In one instance a small dose of this substance caused death by producing intestinal hæmorrhage. (See the same Journal, June 10, 1853, p. 513.) Mr. Procter, of York, communicated to me, in July 1860, the cases of four children to whom, by mistake, a mixture of sulphur and tartar emetic had been given. An ounce of sublimed sulphur and one drachm of tartar emetic had been divided among the four. The symptoms presented the same characters in each; early vomiting which became violent and incessant, pain in the bowels, purging, great thirst, cold clammy perspiration, feeble pulse, cramps of the limbs and twitchings of these parts, with great depression. There was no sense of heat or constriction in the throat, and no difficulty of swallowing. Under treatment they all recovered.

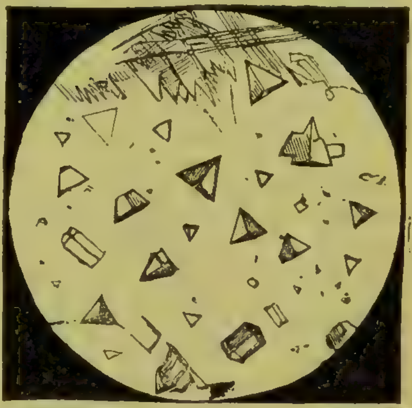
Appearances.—The following cases, reported by Mr. Hartley, show the nature of the appearances likely to be found after death. Two children, a boy aged five years, and a girl aged three years, each swallowed a powder containing *ten grains* of tartar emetic mixed with a little sugar. It was stated that, in twenty minutes after taking the powders, they were seized with violent vomiting and purging, and great prostration of strength, followed by convulsions and tetanic spasms; there was also great thirst. The boy died in eight hours, and the girl in twelve or thirteen hours after swallowing the dose. The bodies were inspected between four and five days after death. In that of the boy there was effusion of serum in the right pleura; the lower lobe of the right lung posteriorly was redder than natural, and the peritoneum was injected from recent inflammation. The mucous membrane of the duodenum was inflamed, and covered with a whitish-yellow viscid secretion; this was observed throughout the intestines, although the colour was of a deeper yellow in the large intestines: there was no ulceration. The peritoneal coat of the stomach was inflamed. The mucous membrane of this organ was also much inflamed, especially about the larger curvature and at the cardiac orifice: there was no ulceration. The contents (about two ounces and a half of a dark bloody fluid, having a slightly acid reaction) were adherent to it; and in one case there was a patch of lymph. The tests used did not indicate the presence of antimony. With regard to other appearances, the tongue was covered with a white fur, and appeared soddened; the throat was not inflamed; the wind-pipe and gullet had a natural appearance. On opening the head the dura mater was found congested; the longitudinal sinus contained a coagulum of lymph, and but little blood. The vessels of the surface of the brain were much injected with dark blood, the whole surface having a deep purple colour. Every portion of the brain, when cut, presented many bloody points. The cerebellum and medulla oblongata were also congested; there was no effusion in the ventricles or at the base of the brain. In the body of the girl the morbid appearances were similar: there were in addition on the arms, legs, and neck, patches resembling the eruption of scarlatina. The arachnoid membrane was more opaque than usual; and on the mucous membrane of the stomach, where the inflammation was greatest, were two or three white spots, each about the size of a split pea, which appeared to be the commencement of ulceration. ('Lancet,' April 25, 1846, 460.) A girl, æt. 16, swallowed a dose of tartar emetic amounting to from forty to sixty grains. There was severe vomiting in a quarter of an hour, and this was soon followed by purging: these symptoms continued for about three hours. She also complained of pain, and a burning sensation down the gullet. The vomited matters were of a dark colour. On the following morning she had recovered from the severity of the symptoms; but in the afternoon there was a relapse. She continually threw her head back and screamed; the skin was warm and moist; the pupils were dilated; and the knees drawn up. She died in about thirty-six hours after taking the poison, and during the six or eight hours previous to her death, she was quite delirious. An inspection was made thirty-six hours after death. The throat appeared swollen; the lungs were slightly congested; the heart was healthy, and contained about six drachms of fluid blood. The stomach contained sixteen ounces of a thick bloody fluid: at the greater extremity the coats were softened, and blood was effused under the mucous coat in several places. The small intestines contained a similar fluid, with much mucus; but there was no appearance of inflammation. Only slight traces of the poison were found in the contents of the stomach by the usual tests, the greater part having probably passed off by vomiting and purging. (Mr. Beale, in 'Lancet,' Jan. 21, 1854.) In animals poisoned by this substance, Dr. Pavy and I have found general inflammation of the lower part of the intestines.

It has been hitherto supposed that the cases in which this poison has proved fatal have been few; but I have elsewhere reported thirty-seven, of which sixteen were fatal. The smallest fatal dose was in a child,—*three quarters of a grain*, and in an adult, two grains; but in this instance there were circumstances which favoured the fatal operation of the poison. ('Guy's Hospital Reports,' Oct. 1857.)

Chronic Poisoning.—A good account of the effects produced by tartar emetic, given at intervals in small doses to healthy persons, has been published by Dr. Mayherhofer ('Heller's Archiv.,' 1846, pts. 2, 3, 4, page 100, *et seq.*) The principal symptoms are,—great nausea, vomiting of mucous and bilious liquids, great depression, watery purging, followed often by constipation of the bowels, small, contracted, and frequent pulse, loss of voice and muscular strength, coldness of the skin, with clammy perspiration, and death from complete exhaustion. Several cases have occurred in this country, which show that tartar emetic has been thus criminally employed. In addition to the cases of *Ann Palmer* and *J. P. Cook*, there are those of *Reg.* v. *M'Mullen*, Liverpool Summer Assizes, 1856; *Reg.* v. *Freeman*, Drogheda Spring Assizes, 1857; and the cases of the *James family* at Liverpool (*Reg.* v. *Winslow*, Liverpool Autumn Assizes, 1860.) The prisoner *Winslow* was indicted for the murder of his mistress, Ann James. It was clearly proved that antimony had been administered to the deceased, not only by the careful discrimination of the symptoms made by Dr. Cameron, but by the detection of the poison in the urine during life by Dr. Edwards. The deceased was at the time labouring under malignant disease affecting the cæcum and stomach, but that her death had been accelerated by antimony, there could be no doubt. The prisoner was acquitted owing to the difficulty of proving the act of administration. The poison had been given at intervals in small doses, and as deceased survived about a fortnight after the last dose, it was found only in traces in the various organs. The death of this woman led to the exhumation of the bodies of three of her relatives who had lived in the same house with her and the prisoner, and had died suddenly some months previously under suspicious circumstances. The viscera of these bodies were examined by Dr. Edwards, Dr. Miller, and myself, and in each case antimony was found in small quantity but still extensively diffused through the organs. There was no reason to suppose that they had taken this antimony voluntarily, and there is no reason to doubt, so far as the history of their cases could be obtained, that they were victims to chronic poisoning by antimony. This was the only cause of death, but it was not suspected at the time. (See 'Guy's Hospital Reports,' October, 1857, and October, 1860; also *Reg.* v. *Hardman*, Lancaster Summer Assizes, 1857.)

Chemical Analysis. Tartar Emetic as a Solid.—In the state of powder it is white and crystalline. It has been occasionally sold by mistake for tartaric acid with soda powders, and sometimes for cream of tartar.—1. It is easily dissolved by water,—it is taken up by fourteen parts of cold, and two of boiling water; the solution has a faint acid reaction, and an acrid metallic taste; it is decomposed by long keeping. It is insoluble in alcohol. 2. The powder dropped into sulphide of ammonium is turned of a deep reddish-brown colour, and is thereby known from other poisonous metallic salts. 3. When heated in a reduction-tube, it is charred, but does not melt before charring, like the acetate of lead. The metal is partially reduced by the carbon of the vegetable acid, and the decomposed mass has a greyish-blue metallic lustre. I have not found that a metallic sublimate is produced in this experiment by the heat of a spirit-lamp. 4. When boiled in water containing one-sixth of pure hydrochloric acid, and metallic copper is immersed in the liquid, a grey deposit of antimony takes place on this metal. The colour of the deposit is violet red if the quantity is very small, but the deposit is black and pulverulent if very large. 5. The solution acidulated with one-tenth part of hydrochloric acid gives in the cold a black deposit on a surface of pure tin. A slip of pure tin-foil may be used in this experiment.

Tartar Emetic in Solution.—1. On slowly evaporating a small quantity on a slip of glass, it will crystallize in *tetrahedra*, and in derivatives of the octahedron. If obtained from a very diluted solution, this crystallization is confused, and resembles that of arsenic. 2. *Diluted nitric acid* added to the solution, throws down a white precipitate (sub-nitrate of antimony); the other two mineral acids act in the same way; but, as they precipitate numerous other metallic solutions, there are objections to them which do not hold with respect to nitric acid. The white precipitate thus formed possesses the remarkable property of being easily and entirely dissolved by a solution of tartaric acid: it is also soluble in a large excess of nitric acid, so that if much of the test be added at once, no precipitate is produced. 3. *Ferrocyanide of potassium* does not precipitate the solution, whereby tartarized antimony is known from most other metallic poisons. 4. *Sulphide of ammonium* or *sulphuretted hydrogen gas*, produces in the solution a reddish orange-coloured precipitate, differing in colour from every other metallic sulphide. The precipitate is not soluble in ammonia, but is dissolved in the dry state by strong hydrochloric acid. The only test available when the quantity of antimony present is small, is sulphuretted hydrogen gas.


Crystals of Tartar Emetic magnified thirty diameters.

The foregoing tests, it will be observed, merely indicate the presence of oxide of antimony, but this is in reality the poison which we have to seek,—the cream of tartar with which it is combined being merely the vehicle; and in a case of poisoning, this is no more the object of medico-legal research than if it were the vehicle for the administration of arsenic or corrosive sublimate. It is, besides, well known that tartarized antimony is the only salt of the oxide of antimony in a soluble form which is likely to be met with in medicine or chemistry. Should it be required to prove the presence of cream of tartar, this may be done by filtering the liquid from which the oxide of antimony has been entirely precipitated by sulphuretted hydrogen gas. On evaporating this liquid, the cream of tartar may be obtained.

In Liquids containing Organic Matter.—Tartar emetic is precipitated by tannic acid in all its forms, but not readily by albumen or mucous membrane; therefore it may be found partly dissolved in the liquids of the stomach, provided no antidote has been administered. The liquid should be filtered, and then strongly acidulated with tartaric acid. A current of sulphuretted hydrogen gas is now passed into it, until there is no further precipitation. The sulphide is collected, washed, and dried. If it is the sulphide of antimony, it will have an orange-red or brown colour, it will be insoluble in a solution of ammonia, and when dried, will be dissolved by a small quantity of boiling hydrochloric acid (forming chloride of antimony) with the evolution of sulphuretted hydrogen gas. The boiling should be continued for several minutes until the liquid is colourless. On adding this solution, if not too acid, to water, a white precipitate of oxychloride of antimony (powder of Algaroth or Algarotti, *Mercurius Vitæ*) falls down. This is characteristic of antimony. A portion of the sulphide, dissolved in hydrochloric acid, may be introduced with pure zinc and sulphuric acid into a Marsh's tube or apparatus, like that described at page 210. The gas which escapes at the jet produces a deep black deposit on paper impregnated with a solution of nitrate of silver; but unless sulphur is present it produces no change on paper impregnated with a salt of lead. When ignited, it burns with a pale yellowish-white flame, producing white fumes of teroxide of antimony. Porcelain, or glass, depressed on the flame, receives a black deposit of reduced metallic antimony, with greyish-coloured layers of oxide at the circumference. There is no metallic lustre, such as is produced by arsenic, under similar circumstances, but on examining the reverse side of the glass, a dim metallic lustre will be perceptible. This deposit, unlike arsenic, is not dissolved by chloride of lime. If a current of the gas is heated to redness in a tube, a tin-white ring of metallic antimony will be deposited close to the heated spot. This is much more fixed than the deposit of arsenic, and cannot, like it, be resolved into a white sublimate of octahedral crystals. If the gas is made to pass through a small quantity of fuming nitric acid containing nitrous acid, it is decomposed, the antimony is peroxidized, and may be obtained as a white, insoluble residue on evaporation. A solution of nitrate of silver produces no change of colour in this deposit; but if one or two drops of ammonia are added, there is a black precipitate of antimonide of silver.

The following method of detecting antimony, when dissolved in any organic liquid, is based upon the principle by which copper and other metals may be detected under similar circumstances (page 246). Acidulate a portion of the suspected liquid with hydrochloric acid, and place it in a shallow platinum capsule. Touch the platinum, through the acid liquid, with a piece of pure zinc foil. Hydrogen is evolved, and wherever the metals come in contact, metallic antimony, in the state of a black powder, is deposited upon the surface of the platinum. The liquid should be poured off, and the capsule thoroughly washed with distilled water. This may be effected without disturbing the deposit. A small quantity of sulphide of ammonium poured on the black deposit, speedily dissolves it (if antimony) by the aid of heat, and on evaporation, an orange-red sulphide of antimony remains. This may be dissolved by a few drops of strong hydrochloric acid, and on adding the acid liquid to water, hydrated oxychloride of antimony is precipitated. By this process antimony in small quantity may be detected in any liquid containing organic matter.

In the Tissues.—The antimony may be in so small a quantity, as it is deposited in the organs, that neither the sulphuretted hydrogen nor the galvanic process will yield any satisfactory results. The liver or other organ should be finely cut up, and boiled in a mixture of one part of hydrochloric acid, and five parts of water. After some time, the liquid may be tested by introducing into it a slip of polished copper foil free from antimony. If antimony is present in small quantity, the copper will acquire a reddish or violet-coloured deposit on its surface: if in large quantity, the deposit will be grey with a metallic lustre, or sometimes in the state of a black powder. These deposits do not yield octahedral crystals like those obtained from arsenic. A slip of pure tin-foil may be suspended in the cold, in another portion of the acid liquid, diluted so that the hydrochloric acid forms only one-tenth part by measure. Either immediately, or in the course of a few hours, if antimony is present, the tin is covered with a black deposit of metallic antimony. As arsenic is not deposited on pure tin under similar circumstances, this furnishes a ready method of detecting the admixture of antimony with arsenic. These may be regarded as trial tests. For the demonstration of the presence of antimony, when in mere traces, we may resort to the following process, by which antimony may be completely separated from organic substances. Coil a portion of pure zinc-foil round a portion of clean platinum-foil, and introduce the two metals into the hydrochloric-acid decoction of the tissues, just sufficiently diluted to prevent too violent an action on the zinc. (See illustration, p. 227.) Warm the organic liquid, and suspend the coils in it. Sooner or later, according to the quantity of antimony present, the platinum will be coated with an adhering black powder of metallic antimony. Wash the platinum-foil, and digest it in strong nitric acid. So soon as the black deposit of antimony is dissolved from its surface, the platinum may be removed. Add a few drops of nitric acid, and evaporate the acid liquid to dryness. The residue, redissolved in hydrochloric acid, and the solution diluted and treated with a current of sulphuretted hydrogen, will yield an orange-red sulphide of antimony.

This black deposit of antimony is readily dissolved from platinum by sulphide of ammonium, yielding on evaporation, an orange-red sulphide of antimony, and it is also soluble in nitrohydrochloric acid, but not in hydrochloric acid alone. When kept for a few days in contact with water and air, the black metallic deposit is sometimes converted into white oxide of antimony, and entirely disappears.

A medical jurist must remember that the discovery of tartar emetic in the contents of a stomach is by no means a proof of its having been taken or administered as a poison; since it is frequently prescribed as a medicine, and often taken as such by persons of their own accord. We could only suspect that it existed as a poison, or had caused death, when the quantity present was large, and there were corresponding appearances of irritation in the stomach and bowels. The presence of any quantity, if not lawfully administered as a medicine, is always a suspicious fact, and demands explanation. In two cases of criminal administration in small doses, the quantity found in each body, did not exceed three grains. The mere discovery of it in a medicinal mixture cannot of itself be evidence of an intent to poison.

The separation of antimony from the tissues does not necessarily indicate that it has been criminally administered or has caused death; but its presence should be reasonably accounted for, as antimony may have been unlawfully administered. In several cases of suspected death from poison, deposits on copper, evidently of an antimonial nature, have been obtained from the liver or tissues. On inquiry it has been found that antimonial medicines had been taken shortly before death. Conversely, when no antimony is found, or the metal is present in the tissues in minute quantity, it is still consistent with medical experience and observation that the person may have died from antimony. The case of *Mrs. Peters*, of Yeovil (July, 1860), furnishes a recent and remarkable illustration of this fact. This lady had symptoms during her illness which were referred by her medical attendants to the effects of small doses of antimony. Antimony was found in the urine both by them as well as by Mr. Herapath: but after death (*i. e.* in about nine days) no antimony was found in the tissues or any part of the body. Upon this fact and the evidence of coexisting disease, it was alleged that she had died from disease and not from poison. The jury returned a verdict to the effect that her death had been accelerated by irritant poison. ('Med. Times and Gazette,' Aug. 25, 1860, p. 190; Sept. 15, p. 271; and Sept. 29, p. 317.) Assuming the results of the analysis of the urine during life to be correct, there can be no question that antimony was administered to her; and the statement of the acceleration of death is rendered probable. The case is important in this respect; it shows that antimony may be found in an evacuation and that death may be accelerated by it; but although the person may die within nine days, none will be detected in the body.

Chloride or Butter of Antimony.—*Symptoms and Appearances.*—A boy, aged twelve, swallowed by mistake for ginger beer four or five drachms of a solution of butter of antimony. In half an hour he was seized with vomiting, which continued at intervals for two hours. There was faintness, with general weakness, and great prostration of strength. Remedial means were adopted, and the next day the chief symptoms were heat and uneasiness in the mouth and throat, with pain in swallowing. There were numerous abrasions on the mucous membrane of the mouth and throat; and there was slight fever, from which the boy quite recovered in about eight days. Another case of recovery from a dose of an ounce is reported in the 'Lancet,' Feb. 26, 1848, p. 230. I am indebted for the following case to Mr. Mann. An army surgeon swallowed, for the purpose of suicide, from two to three ounces by measure of chloride of antimony. About an hour afterwards he was seen by Mr. Mann. There was entire prostration of strength, with coldness of skin, and incessant attempts to vomit. The most excruciating griping pains were felt in the abdomen; and there was a frequent desire to evacuate the bowels, but nothing was passed. In the course of a few hours reaction took place, the pain subsided, and the pulse rose to 120. There was now a strong disposition to sleep, so that he appeared as if labouring under the effects of a narcotic poison. In this state he continued until he died, ten hours and a half after he had swallowed the poison. On inspection the interior of the alimentary canal from the mouth downwards to the jejunum, presented a black appearance, as if the parts had been charred. In general, there was no mucous membrane remaining, either on the stomach or elsewhere; only a flocculent substance, which could be easily scraped off with the back of the scalpel, leaving the submucous tissue and the peritoneal coat. All these parts were so soft that they were easily torn by the fingers.

Analysis.—1. If any portion of the chloride is left in the vessel, it may be tested by adding a few drops to a large quantity of water, when the whitish-yellow oxychloride of antimony will be precipitated: the supernatant liquid will contain hydrochloric acid, which may be detected by nitrate of silver. 2. The precipitated white oxychloride is dissolved by a solution of tartaric acid. 3. This acid solution is precipitated of an orange red colour by a current of sulphuretted hydrogen gas.

In the Tissues.—Any antimonial compound may be dissolved out of the coats of the stomach or other structures, by boiling them in hydrochloric acid. The solution when cold may be diluted with nine parts by measure of water, and a slip of pure tin foil suspended in the liquid. A black deposit on the tin, after sufficient contact, indicates the presence of antimony. The metal may be then separated by platinum and zinc, according to the method described at page 253.

Preparations of Zinc.

White Vitriol. *Sulphate of Zinc. Symptoms and Appearances.*—The symptoms produced by an over-dose of sulphate of zinc are pain in the abdomen and violent vomiting, coming on almost immediately, followed by purging. After death the stomach has been found inflamed. The sulphate appears to act as a pure irritant; it has no corrosive properties. This salt may cause death indirectly as the result of exhaustion from violent vomiting, when an ordinary dose has been given to a person already debilitated by disease.

('Med. Times and Gaz.,' July 16, 1853, p. 78.) Dr. Gibb has reported a case of poisoning by this substance, in which a lady recovered after taking sixty-seven grains. ('Lancet,' May 17, 1856.) A case is reported by Dr. Ogle, in which it is supposed that it destroyed life by its slow or chronic effects. ('Lancet,' Aug. 27, 1859, p. 210.) Neither the sulphate nor the oxide of zinc can be regarded as powerful irritants. In cases of epilepsy Dr. Babington gave sulphate of zinc in doses of two scruples, three times a day, having at first commenced with small doses. No ill-effects followed, and none of the usual symptoms of irritation were observed. This may have been owing to a tolerance of the medicine. With respect to the *oxide of zinc*, Dr. Marcet states that he has prescribed it in large doses without injury to health. One patient, an epileptic, took as much as one pound in seven months, the largest quantity taken in one day being seventy grains. Although he did not suffer from the remedy the disease was not cured. ('Lancet,' March 1, 1862, p. 224.)

Analysis.—The pure sulphate is seen in white prismatic crystals, closely resembling in appearance sulphate of magnesia and oxalic acid; from oxalic acid it is distinguished by remaining fixed when heated on platinum-foil,—from the sulphate of magnesia, by tests applied to its solution. It is readily dissolved by water, this fluid taking up about one-third of its weight at common temperatures. Analysis of the *solution.*—The solution has a slightly acid reaction. The following tests may be used for the detection of oxide of zinc. 1. *Ammonia* gives a white precipitate, soluble in an excess of the alkali. 2. *Carbonate of ammonia*, a white precipitate, also soluble in a large excess of the test. 3. *Ferrocyanide of potassium*, a white precipitate. 4. *Sulphuretted hydrogen* and sulphide of ammonium, a milky-white precipitate, provided the solution is *pure* and neutral, or nearly so. If the solution is very acid, sulphuretted hydrogen produces no effect whatever.

In Organic Mixtures.—If the sulphate of zinc is dissolved and the solution is not too acid, we may pass into it a current of sulphuretted hydrogen gas; the presence of zinc is immediately indicated by a milky-white froth: the sulphide may be collected, and decomposed by boiling it with hydrochloric acid. The solution may be then tested for zinc. This compound being frequently employed as an emetic, may be innocently present in an organic liquid, or in the contents of the stomach.

CHLORIDE OF ZINC.—The chloride of zinc is sold to the public as a disinfectant, under the name of 'Sir W. Burnett's Fluid.' This is a highly concentrated solution of the pure, or sometimes impure, chloride of the metal; it has been taken by accident in several cases, and in one instance was supposed to have been criminally administered as a poison.

Symptoms.—In a case reported by Dr. Stratton, about two ounces of a solution containing only twelve grains of the chloride were swallowed. The patient immediately felt pain and nausea; vomiting followed, and she recovered, but suffered from some indisposition for three weeks. In a second case, a wine-glassful, equivalent to at least two hundred grains of solid chloride, was swallowed. The man instantly experienced a burning pain in the gullet, burning and griping pain in the stomach, great nausea, and coldness. Vomiting came on in two minutes; the legs were drawn up to the body; there was cold perspiration, with other signs of collapse. The man perfectly recovered in sixteen days. ('Ed. Med. and Surg. Journal,' Oct., 1848, p. 335; and British American Journal,' Dec., 1848, p. 201.) Other cases show that the concentrated liquid has a strong corrosive action, destroying the membrane of the mouth, throat, gullet, and stomach. There has been frothing of the mouth, with general lividity, and coldness of the skin. In a case in which only a mouthful of the fluid had been swallowed, the patient experienced giddiness and loss of sight, with immediate burning heat in the stomach:

vomiting and purging came on, and the former symptom continued for a week. There was so much irritability of the stomach for a period of three weeks, that the patient became greatly reduced. Among the early symptoms was loss of voice, which did not return for five weeks. ('Med. Times,' Oct. 11, 1851, p. 382; and Nov. 8, 1851, p. 497.) Dr. R. Hassall met with a case in which the nervous symptoms were strongly marked, and were of a peculiar kind. Three ounces of 'Burnett's Fluid' were swallowed. There was immediately a sense of constriction in the throat, with a hot burning sensation in the stomach. There was no pain in the mouth, and there was no appearance of corrosion in this cavity or on the lips. There was incessant vomiting, the vomited matters consisting of thick mucus, streaked with blood; and some portion of mucous membrane was discharged. There was no purging until the third day, when the discharges from the bowels had a coffee-ground appearance. After the lapse of a fortnight, a train of nervous symptoms set in, indicated by a complete perversion of taste and smell. The patient recovered in about three months. ('Lancet,' Aug. 20, 1853, p. 159.) A case which occurred to Dr. Markham proved fatal in about *ten weeks* after the poison had been swallowed. The patient, a woman, æt. 46, took half a wine-glassful of Burnett's liquid, equal to about one hundred grains of chloride of zinc. Immediately after taking it, she suffered from vomiting and pain in the stomach. She drank freely of water: the vomiting ceased in a few days, and she appeared to have recovered. In about three weeks the vomiting returned: it was incessant, and with this there was pain in the stomach. She sank exhausted, evidently from the secondary effects of the poison. ('Medical Times and Gazette,' June 11, 1859, p. 595.)

Appearances after Death.—In the case of an infant, aged fifteen months, who died from the effects of this poison, the lining membrane of the mouth and throat was white and opaque. The stomach was hard and leathery, containing a liquid like curds and whey. Its inner surface was corrugated, opaque, and tinged of a dark leaden hue. The lungs and kidneys were congested. The fluid of the stomach was found to contain chloride of zinc. ('Med. Times,' July 13, 1850, p. 47.) These facts show that the concentrated solution of chloride of zinc is both a corrosive and an irritant poison, exerting also occasionally an action on the nervous system. In a case which proved fatal at Guy's Hospital, in 1856, the coats of the stomach were excessively thickened, and had a leathery consistency. In Dr. Markham's case, the stomach was so constricted at the intestinal end by a cicatrix that it would only admit a crow-quill. The opening was involved in this cicatrix, which was about one quarter of an inch wide. There was no other sign of disease in the body. This case proves that death may occur from this poison even after apparent recovery. The chloride of zinc may destroy life either by producing stricture of the gullet or pylorus, or by its chemical action on the lining membrane of the stomach leading to a loss of power of digestion, emaciation, and exhaustion. In 1863 several deaths were reported to have taken place in consequence of Burnett's Fluid having been mistaken for medicine. In one of these a lady swallowed a wine-glassful in place of fluid magnesia. She suffered severely, and died from the secondary consequences of the poison, after six weeks. In another, a girl, æt. 17, swallowed half a wine-glassful of the fluid, and died from the effects in less than two hours. The symptoms here were copious vomiting of frothy mucus with shreds of membrane, and cramps in the legs, which were drawn up to the abdomen.

Analysis.—The chlorine may be detected by nitrate of silver—the zinc by the tests above described. (See Sulphate.) All the samples which I have examined contained iron.

Zinc can be detected in the *tissues* only by incineration and an examination of the ash. The chloride is, however, sometimes used for the preservation of the dead body. This might account for its occasional presence.

PREPARATIONS OF TIN.

The only preparations of this metal which require to be noticed as poisons are the *Chlorides*, or *Muriates*, a mixture of which is extensively used in the arts, under the name of *Dyer's Spirit.* The salts may exist in the form of whitish-yellow crystals; but more commonly they are met with in a strongly acid solution in water. They are irritant poisons; but so seldom used as such, that only one death occurred from them in England and Wales during a period of two years.

PREPARATIONS OF SILVER.

Nitrate of Silver. Lunar Caustic. Lapis Infernalis.—This substance, which is commonly met with in small sticks of a white or dark-grey colour, is readily soluble in distilled water; in common water it forms a milky solution. It acts as a powerful corrosive, destroying all the organic tissues with which it comes in contact. There are at least two cases on record in which it has proved fatal in the human subject: one of these occurred in 1837-8, but the particulars are unknown. The symptoms come on immediately, and the whitish-flaky matter vomited is rendered dark by exposure to light. Dark-coloured spots on the exposed parts of the skin will also indicate the nature of the poison. In September, 1861, a woman, æt. 51, died in three days from the effects of taking a six-ounce mixture containing fifty grains of nitrate of silver (lunar caustic) given in divided doses. She vomited a brownish-yellow fluid before death. The stomach and intestines were found inflamed. It is stated that silver was found in the substance of the stomach and liver.

PREPARATIONS OF GOLD.

Perchloride.—This is the only preparation of gold which requires notice. t is a powerful irritant poison, acting locally like the nitrate of silver. Nothing is known of its poisonous effects on man; but, in administering t to animals, Orfila found that it caused extensive inflammation, and even lceration, of the mucous membrane of the stomach. ('Toxicologie,' vol. 2, p. 30.) The metal is absorbed and carried into the tissues, but its poisonous ction appears to be wholly independent of absorption.

PREPARATIONS OF IRON.

Sulphate of Iron. Copperas. Green Vitriol.—This compound has been everal times administered with malicious intention. One death from it took lace in 1837-8. It cannot, however, be an active preparation; for a girl ho swallowed an ounce of it recovered, although she suffered for some hours rom violent pain, vomiting, and purging. ('Christison on Poisons,' p. 506.) reen vitriol or copperas is sometimes given as an abortive. A suspicious ase is reported, in which a woman far advanced in pregnancy, but enjoying ood health, was suddenly seized at midnight with vomiting and purging, nd died in about fourteen hours. The body, which had been buried, was isinterred, and iron found in large quantities in the viscera. The symptoms re not always of this violent kind. In a case which occurred to M. Che-lier, a man gave a large dose of sulphate of iron to his wife. There was either colic nor vomiting. The woman lost her appetite, but ultimately ecovered. In another case reported by the same authority, a woman was ried and convicted of poisoning her husband with sulphate of iron: but in consequence of the great diversity of opinion among the scientific witnesses at the trial respecting the poisonous properties of this metallic salt, and the dose in which it would be likely to operate injuriously, the Court and Jury recommended that the sentence of death should not be carried into execution. ('Ann. d'Hyg.' 1851, vol. 1, p. 155; 'Med. Gazette,' 1850, vol. 45, p. 640.) The reader will find some remarks in reference to the action of the sulphate of iron on the body, by the late M. Orfila, in the same Journal, 1851, vol. 2, p. 337. At the Nottingham Autumn Assizes, 1859, a woman of the name of *Riley* was indicted for administering copperas to two children. She put the substance into gruel. It gave to the gruel a greenish colour and a peculiar taste, which led to the discovery. It caused sickness, but no other serious symptoms. As there was no evidence of an intent to murder, and it was then not unlawful to administer poison with any other intent, the prisoner was acquitted. This salt has been much used for criminal purposes in France. (See 'Medical Gazette,' vol. 47, p. 307: also 'Ann. d'Hyg.' 1850, vol. 1, pp. 180, 416; and 1851, vol. 1, p. 155; vol. 2, p. 337.) Sulphate of iron is said to have proved fatal to sheep. It had been mixed with the pulp of beetroot for cattle food. ('Med. Times and Gazette,' 1863, vol. 1, p. 511.)

Muriate of Iron. Tincture of Perchloride of Iron.—This is an acid solution of perchloride of iron in rectified spirit: it is of a red-brown colour, and is much used in medicine. It is sometimes made with wood-spirit or methylated spirit, which gives to it a peculiar odour. Dr. Christison relates an instance in which a man by mistake swallowed an ounce and a half of this liquid: the symptoms were somewhat like those produced by hydrochloric acid. He at first rallied, but died in about five weeks. The stomach was found partially inflamed, and thickened towards the intestinal end. A case was reported to the Westminster Medical Society, in November 1842, in which a girl, æt. 15, five months advanced in pregnancy, swallowed an ounce of the tincture of muriate of iron in four doses in one day, for the purpose of inducing abortion. Great irritation of the whole urinary system followed; but this was speedily removed, and she recovered. In another case, reported by Mr. Amyot, a healthy married woman swallowed, by mistake for an aperient draught, *one ounce and a half* of the tincture of muriate of iron. She immediately ejected a portion, and violent retching came on which continued for some time. There was great swelling of the glottis, with cough, and difficulty of swallowing. These symptoms were followed by heat and dryness of the throat, with a pricking sensation along the course of the gullet and stomach; and in the afternoon a quantity of dark liquid blood was vomited. The motions were black, owing doubtless to the action of sulphur upon the metal. In about a month the patient was perfectly restored to health. ('Provincial Journal,' April 7 and 21, 1847, p. 180.) Another case of recovery from a large dose has been reported by Sir James Murray. The patient, æt. 72, swallowed by mistake *three ounces* of the tincture in a concentrated state. The tongue soon became swollen; a ropy mucus flowed from the mouth and nose; there was croupy respiration, with a sense of impending suffocation. The pulse was feeble, the skin cold and clammy, and the face swollen and livid. A castor-oil mixture brought away inky evacuations, and the patient rapidly recovered. ('Dub. Med. Press,' Feb. 21, 1849.) From the occurrence of these cases of recovery, it would be a mistake to infer that this is not a noxious compound. The largeness of the dose has commonly led to early vomiting, and the rejection of the greater part of the acid liquid. Besides, it varies much in strength, and unless this is defined in any given case, it is difficult to draw an inference of the actual quantity taken.

Comparatively small doses may seriously affect pregnant females, and mong the criminal uses to which this preparation is put, may be mentioned hat of procuring abortion. At the Lincoln Lent Assizes, 1863 (*Reg.* v. *umble*) a druggist was convicted of having supplied this noxious liquid to a roman with the intent to procure her miscarriage. He directed her to take teaspoonful three times a day, and at the same time had prescribed for her, ight pills a day, each containing half a grain of powdered cantharides. lthough the woman had taken only two doses of the tincture of perchloride f iron, she suffered from severe pain over the whole of the abdomen, with iolent pain in the region of the stomach and bladder: there was constant omiting of a greenish-coloured matter, and great pain in passing her urine. he quantity of urine secreted was small, and contained much blood. These mptoms were in great part due to the cantharides. The proper dose of the on-tincture is from ten to forty mimims. Here it had been greatly exceeded ithout any lawful excuse on the part of the prescriber.

Chemical Analysis.—The hydrochloric acid may be detected by nitrate of lver and nitric acid, while the peroxide of iron is immediately indicated by precipitate of Prussian blue on adding a solution of *Ferrocyanide of potas- um.* The quantity present may be determined by evaporation.

Preparations of Bismuth.

Subnitrate of Bismuth. Pearl-White. Magistery of Bismuth.—This sub- ance, in a dose of *two drachms*, caused the death of an adult in nine days. here was a strong metallic taste in the mouth, burning pain in the throat, ith vomiting and purging, coldness of the surface, and spasms of the arms nd legs. On inspection, the throat, windpipe, and gullet were found in- amed; and there was inflammatory redness in the stomach and throughout ie intestinal canal. ('Sobernheim,' p. 335.) In a case mentioned by Dr. raill, a man took by mistake *six drachms* of the subnitrate, in divided doses, three days. He suffered from vomiting and pain in the abdomen and iroat, but finally recovered. ('Outlines,' p. 115.) These cases are sufficient prove that a substance which is but slightly soluble in water may exert powerfully poisonous action. The oxide and subnitrate of bismuth, owing imperfect washing, are frequently contaminated with arsenic in the form of rsenic acid.

The symptoms produced by large doses have closely resembled those used by arsenic, and as the medicinal subnitrate generally contains arsenic, e symptoms may have been due to this impurity. I found arsenic in com- ratively large proportion, in samples obtained from three respectable retail uggists. Only two specimens out of five were found free from this poison. he arsenic may be detected by dissolving the subnitrate in pure hydrochloric id slightly diluted, and introducing it into Marsh's apparatus. The arse- al flame is apparent on combustion, and the usual deposits may be tained on glass and porcelain. The products of combustion may be col- cted and tested by the processes described at p. 205. This impurity of the bnitrate may modify a conclusion respecting the presence of traces of arsenic a body when bismuth has been administered medicinally. (See 'Brit. and pr. Med. Chir. Rev.' Oct. 1858.)

Analysis.—The subnitrate is a whitish chalky-looking uncrystalline wder insoluble in water, dissolved by hydrochloric acid, and again pre- pitated white by dilution with water:—the white precipitate is insoluble tartaric acid, and is blackened by a solution of sulphuretted hydrogen, or sulphide of ammonium. A solution of the substance in nitric acid gives precipitate with diluted sulphuric acid.

Preparations of Chromium.

Bichromate of Potash.—Well-observed instances of poisoning by this compound, which is now extensively used in the arts, are rare; and therefore, the details of the following case, communicated to the 'Medical Gazette' (vol. 33, p. 734) by Mr. Wilson of Leeds, are of practical interest. A man, æt. 64, was found dead in his bed twelve hours after he had gone to rest: he had been heard to snore loudly during the night, but this had occasioned no alarm to his relatives. When discovered he was lying on his left side, his lower limbs being a little drawn up to his body: his countenance was pale, placid, and composed; eyes and mouth closed; pupils dilated; no discharge from any of the outlets of the body; no marks of vomiting or purging, nor any stain upon his hands or person, or upon the bed-linen or furniture. The surface was moderately warm. Some dye-stuff, in the form of a black powder, was found in his pocket. On inspection, the brain and its membranes were healthy and natural; there was neither congestion nor effusion in any part. The thoracic viscera were equally healthy, as well as those of the abdomen, with the exception of the liver, which contained several hydatids. A pint of a turbid inky-looking fluid was found in the stomach. The mucous membrane was red and vascular, particularly at the union of the greater end with the gullet: this was ascribed to the known intemperate habits of the deceased. In the absence of any obvious cause for death, poison was suspected; and on analyzing the contents of the stomach they were found to contain bichromate of potash. The dye-powder taken from the man's pocket consisted of this salt mixed with cream of tartar and sand. It is remarkable that in this case there was neither vomiting nor purging. The salt does not appear to have operated so much by its irritant properties, as by its indirect effects on the nervous system. This, however, is by no means an unusual occurrence, even with irritants far more powerful than the bichromate of potash. A case has been communicated to me by Mr. Bishop, of Kirkstall, in which a boy recovered from the effects of a dose of this salt only after the lapse of four months. The first symptoms were pain, vomiting, dilated and fixed pupils, cramps in the legs, and insensibility. His recovery was due to early and active treatment. A report of this case will be found in 'Guy's Hosp. Reports,' Oct. 1850, p. 214.

Crystals of bichromate of potash magnified thirty diameters. They have a deep orange-red colour.

There can be no doubt that bichromate of potash is an active poison. Mr. West has published a case from which it appears that a medical man, who had inadvertently tasted a solution of it, suffered from severe symptoms resembling those of Asiatic cholera. ('Provincial Journal,' Dec. 24, 1851, p. 700.) Mr. Wood, of St. Bartholomew's Hospital, has furnished me with the particulars of a case in which two drachms of this substance destroyed the life of a woman in *four hours*. In the first two hours, she suffered from violent vomiting and purging, the vomited matters being of a yellow colour. When admitted she was in a dying state, pulseless, unconscious, and breathing slowly, and with great effort. The skin was cold; the lower lip swollen and purple, and the tongue swollen. The chief appearances were, a dark and liquid state of the blood; the mucous membrane of the stomach in great part destroyed, of a dark brown colour approaching to purple; the duodenum at its upper part, of a florid red colour, and at its lower part, much corrugated, as well as the upper half of the jejunum. This salt has an irritant local action on parts from which the skin has been removed. (See 'Annales d'Hygiène,' 1864, vol. 1, p. 83.)

Analysis.—The bichromate may be recognized by its orange-red colour, as well as by the intense yellow colour which it gives to water when dissolved. Its solution gives a deep red precipitate with nitrate of silver, and a pale yellow with nitrate of baryta.

Preparations of Thallium.

The salts of this newly-discovered metal are, according to M. Paulet, highly poisonous, although this does not appear either from his own statement of their effects or from the experiments of M. Lamy. M. Paulet found that a dose of fifteen and a half grains of carbonate of thallium killed a rabbit in some hours. The animal suffered from disturbance of breathing, loss of muscular power, and general trembling of the limbs; it appeared to die asphyxiated. The salts of the metal operated through the skin and cellular membrane, therefore by absorption.

Lamy dissolved seventy-five grains of the sulphate in milk, and he found that this quantity sufficed to destroy two hens, six ducks, two puppies, and a middle-sized bitch. The prominent symptoms in the dogs, were oppression of breathing, salivation, griping pains in the abdomen, the body being drawn up, with trembling and convulsions of the limbs, followed by paralysis. Vomiting and purging are not described among the symptoms. Two of the puppies did not die until four days after they had taken the poison. On opening the bodies of the animals, Lamy states that there was no mark of inflammation or other striking post-mortem appearance. In one experiment he found that a puppy died in forty hours from a dose of one grain and a half of the sulphate of thallium ('Chem. News,' Sept. 12 and 19, 1863).

The salts are soluble, colourless, and nearly tasteless, and therefore may be easily administered.

These statements of MM. Lamy and Paulet are not in accordance with the views of the discoverer of the metal, Mr. Crookes. Although much exposed to the action of the fumes, the metallic vapour produced no particular effects upon him. He also swallowed a grain or two of the salts without injury. These have a local action on the hair and skin, staining the former, and rendering the latter yellow and horny. ('Chem. News,' Oct. 3, 1863, p. 161.)

Analysis.—According to these experimentalists, the best and most certain method of detecting thallium or its oxide or salts, if used as poisons, is to dry and burn the viscera, when, by the aid of spectrum-analysis, the green band indicative of thallium will manifest itself in the spectrum, from the smallest quantity of the metal, in spite of admixture with other bodies.

The history of thallium as a poison is at present very incomplete. The above facts do not show that it is an energetic substance.

To the foregoing list of mineral irritant poisons may be added one which, although presenting a metallic appearance, is, strictly speaking, a metalloid, namely iodine.

Iodine.

Symptoms.—From experiments on animals, as well as from observation of its effects on man, iodine has a strong local action as an irritant on the stomach and bowels. In large doses, it occasions a burning heat in the throat, severe pain in the abdomen, with vomiting and purging; the vomited matters having the peculiar odour of iodine, and being of a yellow colour, except when any farinaceous food has been taken, in which case they are blue, or even black. The fæcal matters may also contain iodine if the poison has been taken in the solid state. Besides these symptoms, there is great thirst, with anxiety, headache, giddiness, trembling and convulsive movements of the limbs, and fainting; these last symptoms indicating that the poison has become absorbed. When taken for some time in small doses, it gives rise to salivation, vomiting and purging, pain in the stomach, and cramps; the pulse becomes small and frequent; there is a general wasting of the body; and it has been observed that, in this form of chronic poisoning, certain glands are liable to become affected and diminished by absorption,—the breasts in the female, and the testicles in the male. Iodine produces these secondary effects (iodism), whether it is taken internally or applied externally. A woman swallowed by mistake one drachm of iodine dissolved in an ounce of alcohol. When seen soon afterwards, she complained of a violent burning pain in the throat and stomach, followed by retching and slight vomiting; pulse rapid and full; eyes prominent and suffused. Vomiting, promoted by diluents, brought no relief to the symptoms. She became much depressed, and died on the following day. There was no examination of the body. ('Prov. Jour.,' June 30, 1847, p. 356.) For a case of recovery from half a drachm, see 'Med. Times and Gaz.,' Dec. 28, 1861, p. 669.

Iodine is rarely used as a poison. In May, 1864, an attempt was made by a woman to poison a fellow-servant by mixing tincture of iodine with food in a plate. The remarkable discolouration of the farinaceous food which it produced, led to suspicion, and prevented any ill effects from following. Iodine gives a blue, green, or dark colour to most organic liquids, and imparts to them a peculiar odour. It stains the skin and other organic substances yellow; the colour being removed by an alkali. When in strong solution, it is corrosive and destroys the parts which it touches; in this state it has been maliciously employed for throwing on the person.

Appearances after Death.—As this is an irritant as well as a corrosive poison, the lining membrane of the gullet, stomach, and intestines is found inflamed and excoriated. In one instance, the mucous membrane near the pylorus, was corroded and detached in a space of two or three inches.

Analysis.—The odour is sufficient to identify it. This may be concealed by alkalies or alkaline substances. When heated, it sublimes in a purple vapour. The addition of a solution of starch produces a blue colour. It is very soluble in sulphide of carbon, forming a rich pink solution. The sulphide has even the property of removing it from water and other liquids in which it is dissolved. It may thus be separated for chemical examination by decanting the watery liquid from the sulphide which, on evaporation, leaves the iodine in crystals.

VEGETABLE IRRITANTS.

CHAPTER 22.

VEGETABLE IRRITANTS—ALOES—COLOCYNTH—GAMBOGE—JALAP—SCAMMONY—SAVIN—CROTON OIL—CASTOR SEEDS—COLCHICUM—HELLEBORE—OIL OF TURPENTINE—OIL OF TAR—MOULDY BREAD—CAROB OR LOCUST BEAN.

General Remarks.—The poisonous substances of an irritant nature which belong to the vegetable kingdom are very numerous as a class; but it will here be necessary to notice only those which have either caused death, or have given rise to accidental poisoning.

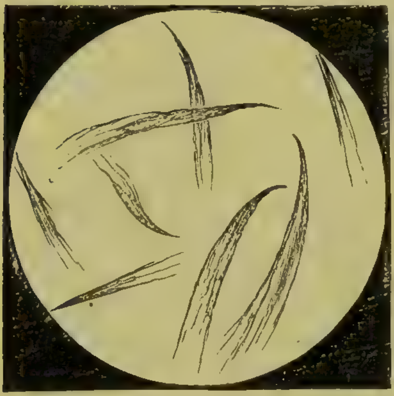
ALOES. COLOCYNTH. GAMBOGE. JALAP. SCAMMONY.

These different substances, which are used in small doses as medicines, are liable, when taken frequently or in large quantities, to excite vomiting, purging, and other symptoms of irritation. Colocynth has occasioned death in several instances: in one case a teaspoonful and a half of colocynth powder destroyed life; and one drachm of gamboge, a medicine much used by quacks, has proved fatal to man. (Traill's 'Outlines,' 150.) Aloes and colocynth mixed are said to be the basis of a certain quack medicine sold under the name of Morison's Pills. These have proved fatal in many instances from the exhaustion produced by excessive purging, owing to the large quantity of these pills taken in frequently-repeated doses. Our knowledge of the symptoms and appearances produced by these irritants is, indeed, chiefly derived from the cases which have proved fatal under this pernicious treatment. In the seventeenth volume of the 'Medical Gazette' will be found four cases of this description. The most prominent symptom is excessive purging, with the discharge of large quantities of mucus; the individual becomes exhausted, and slowly sinks. In some instances, the symptoms are those of inflammation and ulceration of the bowels. In 1836, a man was convicted of having caused the death of a person by the administration of these pills; in this instance the death of the deceased was clearly due to the medicine, and on inspection the stomach was found inflamed and ulcerated, the mucous membrane of the small intestines was inflamed and softened, and there was the appearance of effused lymph upon it. An ingenious attempt was made in the defence to draw from the medical witness a statement that the good effects of some medicines invariably increased in proportion to the quantity taken. This was, however, very properly denied. The same remarks apply to Holloway's pills, although these are of a more innocent description. The principal ingredient in them is aloes. In all cases it must be remembered that these drastic purgatives may cause serious symptoms, or even death, when administered to infants, or to persons debilitated by age or disease; and it is not necessary that the dose should be very large in order that fatal effects should follow. The question here will be, whether the medicine caused death, or whether it simply accelerated it: although, in a legal view, that which accelerates, causes.

HIERAPICRA (*Holy bitter*) is a popular aloetic compound, and one death is recorded to have been produced by it in 1837–8. There is reason to believe that it is occasionally used for the purpose of procuring criminal abortion. A man was tried and convicted of this offence at the Aylesbury Lent Assizes, 1857 (*Reg.* v. *White*), and the noxious properties of this compound then became a subject of inquiry. The dose, and the condition of the woman to whom it is administered, will of course affect the answer to this question. At the trial above mentioned, it was properly considered to be a noxious substance within the meaning of the statute. The fact that, under the name of *Pulvis Aloes cum Canellâ*, it was formerly admitted into the British Pharmacopœias, cannot justify the mischievous uses to which it may be put. *Hierapicra* is a snuff-coloured powder, of an intensely bitter taste. It consists of four parts, by weight, of aloes, and one part, by weight, of powdered Canella bark. The proper medicinal dose was formerly fixed at from five to fifteen grains. Its injurious effects on pregnant females are chiefly due to the aloes. This specially affects the rectum, and by contiguity, under violent irritation or purging, may affect the uterus. From the taste and colour which it imparts to liquids, it is not probable that it could be taken by a female unknowingly.

Death has been caused by aloes taken in nitric acid; but in this case the mineral acid was most probably the destructive agent. A singular case occurred in Germany a few years since, wherein a medico-legal question was raised respecting the poisonous properties of *Aloes*. A woman, æt. 43, not labouring under any apparent disease, swallowed two drachms of powdered aloes in coffee. Violent purging supervened, and she died on the following morning, twelve hours after having taken the medicine. On inspection the stomach was found partially, and the small intestines extensively, inflamed. There were no other particular appearances to account for death, and this was referred to the effect of the aloes.

SAVIN. (JUNIPERUS SABINA.)


Tips of the leaves of Savin magnified thirty diameters.

This is a well-known plant, the leaves of which contain an irritant poison in the form of an acrid volatile oil of a remarkable odour. They exert an irritant action, both in the state of infusion and powder. They yield by distillation a light yellow oil, on which the irritant properties of the plant depend. The powder is sometimes used in medicine, in a dose of from five to twenty grains. Savin is not often taken as a poison for the specific purpose of destroying life; but this is occasionally an indirect result of its use as a popular means of procuring abortion. In this manner it appears to have proved fatal in one case in 1837-8. From the little that is known of its effects, it acts by producing violent pain in the abdomen, vomiting, and strangury. After death, the gullet, stomach, and intestines, with the kidneys, have been found either much inflamed or congested. It has no action as an abortive, except, like other irritants, by causing a violent shock to the system, under which the uterus may expel its contents. Such a result can never be obtained without placing in jeopardy the life of a woman; and when abortion follows, she generally falls a victim. On the other hand, a female may be killed by the poison without abortion ensuing. In May 1845, I met with a case in which death had been caused by savin-powder,—abortion having first taken place. Eight ounces of green liquid were found in the stomach, which, with the gullet and the small intestines, was highly inflamed. The poison was easily identified by placing some of the minute portions of the leaves found in the stomach, under a microscope. ('Med. Gaz.' vol. 36, p. 646.) The *oil of savin* is also powerfully irritant. For an account of this, see 'CRIMINAL ABORTION.'

CAYENNE PEPPER. CAPSICUM.

A trial for manslaughter, which has recently taken place at the Central Criminal Court (*Reg.* v. *Stevens*, May, 1864), renders it necessary to notice a substance much better known as a condiment, than as a vegetable irritant poison. In this case a medical botanist was charged with having caused the death of the deceased, a boy, æt. 15, by administering to him dangerous medicines. The boy was suffering from diseased hip-joint, and, after taking the medicines prescribed by the prisoner, he died. Dr. Letheby examined the stomach, and found in it patches of inflammatory redness, such as would be produced by an irritant. He could detect no poison, but simply bilious matter mixed with cayenne pepper. The mixture prescribed by the prisoner contained this pepper, which the witness considered to be injurious to a person in the condition of deceased. The prisoner was acquitted, the connexion of the death of deceased with his act, being probably considered by the jury as not proved.

In small quantities, this is a well-known stimulant and a useful condiment and medicine. It has a hot, fiery taste, which lasts for a long time on the parts which it touches. It is a powerful stimulant, and in large doses produces difficulty of swallowing, pain in the stomach, and inflammation of the gullet and stomach. Locally applied, it causes redness and even blistering of the skin (Wibmer, Arzneimittel, Art. *Capsicum.*) There is no instance recorded of its having proved fatal. It owes its irritant properties to an acrid resin (*capsicin*), of which it contains 4 per cent. From five to ten grains of the powder is considered to be a medicinal dose.

Guinea Pepper, known as Grains of Paradise, is popularly considered to be highly noxious; but there are no facts to justify this view. This kind of pepper is properly regarded as an aromatic condiment.

CROTON OIL.

This is an oil extracted from the seeds of the Croton tiglium. It is a powerful drastic purgative, producing, in a large dose, severe purging, collapse, and death. A case occurred in Paris, in 1839, in which a man swallowed by mistake two drachms and a half of croton oil. In three-quarters of an hour the surface was cold and clammy, the pulse imperceptible, breathing difficult, and the extremities and face were as blue as in the collapsed stage of cholera. In an hour and a half purging set in; the stools were passed involuntarily, and the abdomen was very sensitive to the touch. The patient complained of a burning pain in the course of the gullet. He died in four hours after swallowing the poison. There was no marked change in the mucous membrane of the stomach. (For another fatal case, see 'Pharm. Journal,' Feb. 1863, p. 379.)

In June, 1850, I was consulted in a case in which it was supposed that this liquid had been employed for the purpose of destroying a horse. In this instance sixty drops had been sold, mixed with two ounces of linseed oil. In man, a dose of from fifteen to twenty drops of the *pure* oil might give rise to excessive purging, and cause death by exhaustion. The cases recorded of its fatal operation are few, and do not enable us to solve this question from observed facts. According to Landsberg, as quoted by Christison ('Dispensatory,' p. 382), thirty drops of the oil have killed a dog; and Dr. Christison states that he has known four grains of the oil to produce an alarming degree of purging. It is frequently mixed with castor oil and other substances, and the presence of these must of course influence the dose required to act fatally. In the 'Medical Gazette' there is a report of a case in which a woman died from the effects of an embrocation containing croton oil, with other drugs. A teaspoonful was incautiously given to her: she immediately complained of a hot burning sensation in her throat. She was an aged person, and died in convulsions in three days. ('Med. Gaz.' vol. 43, p. 41.)

A girl, æt. 19, took by mistake a teaspoonful of a liniment consisting of equal parts of croton and olive oil. In about half an hour she was seen by Dr. Brydon, and she then complained of an intense burning sensation in the throat and gullet: but there was no pain in the stomach. Her pulse was 84. Vomiting came on in a severe form, and this was promoted by a zinc emetic and warm water. After the vomiting had continued for a quarter of an hour, she complained of a severe pain in the stomach. Purging was not a prominent symptom. In a day or two she recovered. ('Edinburgh Medical Journal,' Aug. 1861.)

A case was recently tried at the Liverpool Winter Assizes (*Reg.* v. *Massey and Ferrand*), in which the prisoners were charged with having caused the death of a man by placing in food, of which he and others had partaken, two drachms of powdered jalap, and from two to six drops of croton oil. Several persons, including the deceased, suffered from vomiting and purging; but they recovered, and the deceased himself so far recovered as to be able to go about as usual. He was subsequently attacked with inflammation and ulceration of the bowels, from which he died. The prisoners were acquitted, as the medical evidence at the trial failed to make out the connexion of this subsequent illness with the jalap and croton oil which had been put into the food.

Physic Nut (Jatropha Curcas).

The Jatropha Curcas is a West-Indian plant which produces seeds containing an acrid oil, having some of the properties of croton oil. Four seeds act as a violent cathartic, and severe vomiting and purging have been produced by a few grains of the cake left after the expression of the fixed oil from the bruised seeds. The oil operates powerfully in a dose of from twelve to fifteen drops. It produces a burning sensation in the throat, vomiting, and purging, and other symptoms of irritation, followed by inflammation of the stomach, and bowels. In August, 1858, 139 children in Dublin suffered from the effects of these seeds (‘Medical Times and Gazette,’ Aug., 1858); and in June 1864, a number of boys at Birmingham suffered severely from eating some of these nuts which they had found in a drug-store, but they all recovered.

Castor Seeds.

Of castor oil itself nothing need be said. It is not commonly known that the seeds from which this oil is extracted, contain in the embryo an active poison, and that a few of them are sufficient to produce violent purging and death. The following is an instance of poisoning by these seeds, the only one with which I have met. The deceased, æt. 18, was the sister of a gentleman who was at the time attending my lectures at Guy's Hospital. The deceased, it appears, ate about twenty castor-oil seeds; one of her sisters ate four or five, and another two. This was on a Wednesday evening. In the night they were all taken ill. About five hours after the seeds were eaten, the deceased felt faint and sick; vomiting and purging came on, and continued through the night. On the following morning she appeared like one affected with malignant cholera. The skin was cold and dark-coloured, the features contracted, and the breath cold; the pulse was small and wiry; there was restlessness, thirst, pain in the abdomen, and she lay in a sort of drowsy, half-conscious state. Whatever liquid was taken was immediately rejected, and the matters passed by stool consisted chiefly of a serous fluid with blood. She died in five days without rallying; the two other sisters recovered. On inspection, a large portion of the mucous membrane of the stomach was found abraded and softened in the course of the great curvature. A similar case, in which three seeds destroyed the life of a man in forty-six hours, is reported in the ‘Med. Times and Gaz.,’ May 25, 1861, p. 555. There was general redness of the organ, and the abraded portion presented the appearance of a granulating surface of a pale rose-colour; it was covered by a considerable quantity of slimy mucus. The small intestines were inflamed, and the inner surface of them was abraded. The effects produced on the sisters who recovered, bear out the statement of Dr. Christison, that two or three of the seeds will operate as a violent cathartic.

Meadow-Saffron (Colchicum).

Meadow-saffron (Colchicum Autumnale) contains a poisonous alkaloid,—*colchicina*—the effects of which on animals are similar to those of *veratria*, the alkaloid existing in White Hellebore. The most noxious parts of the plant are the bulbs (or roots) and seeds, but the leaves and flowers have also an irritant action.

Symptoms and Appearances.—In November, 1839, a gentleman swallowed by mistake one ounce and a half of *wine* of colchicum. He was immediately seized with severe pain in the abdomen: other symptoms of irritation came on, and he died in seven hours. No examination of the body was made! In another instance, in which an ounce of the wine was taken, death occurred in thirty-nine hours. (Schneider's 'Annalen,' vol. 1, p. 232.) In one case in which this dose was taken, the person recovered after suffering from cramps in the limbs and twitching of the tendons. ('L'Union Méd.,' Aug. 24, 1848.) A woman, æt. 56, suffering from rheumatism, for whom wine of colchicum had been prescribed, took by mistake an ounce of the wine of the seeds, in divided doses, in twelve hours. She suffered from nausea, violent and profuse vomiting, slight purging, with heat and burning pain in the throat, great thirst, cold clammy skin, feeble pulse, pain in the stomach, and pain in the forehead. Inflammation of the stomach supervened, and the retching, vomiting, thirst, and pain continued for three days. She then recovered. ('Amer. Jour. Med. Sci.,' Jan., 1857; and 'Brit. and For. Rev.,' vol. 19, 1857, p. 409.) In other cases profuse purging has been the most prominent symptom followed by death from exhaustion. ('Pharm. Jour.' July, 1861, p. 45.) In one instance, in which two ounces of the wine were taken, the symptoms did not come on for an hour and a half; there was then copious vomiting of a yellow fluid, severe pain with great tenderness in the abdomen, tenesmus and thirst. The patient died in forty-eight hours, without being convulsed or manifesting any sign of cerebral disturbance. The chief morbid *appearance* was a patch of redness in the mucous membrane of the stomach, near the cardiac orifice; the intestines were slightly inflamed. The head was not examined. ('Medical Gazette,' vol. 10, p. 161; see also Casper, 'Ger. Med.,' p. 450.) A case of poisoning by the medicinal administration of colchicum, has been communicated to me by Mr. Mann, of Bartholomew Close. Three and a half drachms of the wine of colchicum were taken in divided doses, and caused death on the fourth day. There was no inflammation of the mucous membrane, but simply extravasation of blood into the mucous follicles. The mucous membrane has been found softened in two cases of poisoning by the tincture. In two other cases, in which an ounce and a half of the *tincture* was taken, and death ensued in forty-eight hours, no morbid appearances were found. (Casper, 'Ger. Med.,' 1857, p. 451.) For a case of alleged poisoning by wine of colchicum, see Casper's 'Vierteljahrschrift,' 1860, vol. 1, p. 1.

Colchicum has acquired an evil notoriety as a poison chiefly owing to the evidence given at a trial which took place at the Central Criminal Court, in September 1862 (*Reg.* v. *Catherine Wilson*). This woman after having been tried and acquitted for an attempt to poison, with oil of vitriol, the wife of a man with whom she cohabited, was in the following September convicted of the murder of a *Mrs. Soames*, who had died suddenly while nursed by the prisoner six years previously. The body was exhumed, but no poison was found in the remains; yet the medical and other circumstances, as well as the conduct and correspondence of the prisoner, proved to the satisfaction of the Court, that deceased had been destroyed by vegetable poison, most probably colchicum, with the noxious properties of which she was proved to have been well acquainted. From the facts which transpired in reference to this trial, it appeared that the deceased was one of four persons who had at different dates fallen victims to the acts of this woman. 1st, *Peter Mawer*, a master mariner of Boston, died in October 1854: the body was exhumed in 1862, but no poison was detected. 2nd, *Mrs. Jackson*, of Boston, who died in December 1859: the body was exhumed in January 1860, and no poison detected. 3rd, *Mrs. Atkinson*, of Kirkby Lonsdale, who died in October 1860: the body was exhumed in May 1862, and no poison detected. 4th, the case of *Mrs. Soames*, above mentioned. All these persons died suddenly while in a state of health, under similar symptoms, and without any apparent natural cause to account for death. The symptoms as a whole were not reconcilable with any known disease; and they only appeared after the prisoner was proved to have administered, under some pretence or other, food or medicine, the bottle which she employed for this purpose being kept locked up or in her own possession. The motive for the murder in each case, was the acquisition of money or property of which the prisoner came into possession,—in Peter Mawer's case by a will made shortly before his death, and in Mrs. Atkinson's case by an act of robbery after her death. Two other attempts at murder which failed, led to the inference that colchicum was the substance which this woman employed, either in wine or brandy. In these four persons, the symptoms were as nearly as possible of the same character—burning pain in the throat and stomach, intense thirst, violent vomiting and purging, coldness and clamminess of the skin, excessive depression and great weakness. The pulse was small and weak, and death appeared to take place, without convulsions or loss of consciousness, from complete exhaustion. Of these persons, one died on the second, one on the fifth, one on the eighth, and one on the fourteenth day. In most of the cases, the poison was probably given in divided doses: in the last case, the symptoms always appeared every evening after the deceased had taken the tea prepared by the prisoner.

Analysis.—Colchicum in the form of tincture possesses a warm aromatic taste and a peculiar odour. It owes its properties to the alkaloid *colchicina*, which is held dissolved by an acid. The process for detecting this substance consists in neutralizing with potash a portion of the aqueous acid solution (obtained by evaporating the alcoholic tincture) and then adding twice its volume of ether. The mixture should be well shaken. On pouring off the ether, and letting it evaporate spontaneously, an imperfectly crystalline or uncrystalline residue remains. (See 'Pharm. Jour.' 1857, p. 529.) When this is treated with one or two drops of concentrated nitric acid, the presence of colchicina is indicated by the residue acquiring a reddish violet colour which soon disappears.

Black, White, and Green Hellebore.

Symptoms and Appearances.—According to Wibmer, the roots of the black hellebore possess the greatest activity: but the leaves are also highly poisonous when used in the form of infusion. By long boiling the poisonous properties of the plant are diminished, probably owing to the loss of the volatile principle, which is an acrid oil. The roots and leaves have a local irritant action, producing violent vomiting and purging in small doses, with severe pain in the abdomen, followed by cold sweats, convulsions, insensibility and death. The powdered root, in a dose of a few grains, acts like a drastic purgative. In a case reported by Morgagni, half a drachm of the aqueous extract killed a man, æt. 50, in eight hours. The symptoms were severe pain in the abdomen and violent vomiting. After death the whole of the alimentary canal was found inflamed, but especially the large intestines. (Wibmer, op. cit. Helleborus.) A case quoted by the same writer, in which a table-spoonful of the finely-powdered root (taken by mistake for rhubarb) caused severe symptoms of irritant poisoning, which did not disappear for four hours. The man recovered on the fourth day. The experiments performed by Orfila on animals, show that this poison acts like a *local* irritant when applied to a wound. (Op. cit. vol. 2, p. 369.) Hellebore is a favourite remedy for worms with quacks and rural doctresses. It is not, therefore surprising that it should be occasionally administered in an overdose, and cause death. In December 1862, Dr. Edwards met with a case in which a gentleman had swallowed experimentally one drachm of tincture of green hellebore (*veratrium viride*), equal to twelve grains of the powder. He was found soon afterwards in a collapsed state, features sunk, skin cold, and covered with a profuse clammy sweat, pulse scarcely perceptible. He complained of intense pain in the region of the stomach. There was no purging. These symptoms were relieved by treatment, and the next morning the patient had recovered. ('Med. Times and Gazette,' 1863, 1, 5.)

Veratria.—White hellebore owes its noxious properties to the alkaloid *veratria*, which is itself a powerful poison. The late Mr. Callaway communicated to me the following case. A physician prescribed medicinally for a lady, one grain of veratria divided into fifty pills, and three were directed to be taken for a dose. Not long after the dose had been swallowed, the patient was found insensible, the surface cold, the pulse failing, and there was every symptom of approaching dissolution. She remained some hours in a doubtful condition, but ultimately recovered. Supposing the medicine to have been well mixed, and the pills equally divided, not more than one-sixteenth of a grain of veratria was here taken! This case proves that pure veratria is capable of exerting a powerful effect. The common veratria of the shops is sometimes given medicinally, in doses of one sixth of a grain. In the pure state, it forms a brownish-white uncrystalline powder, scarcely soluble in water even on boiling; but is more readily dissolved by alcohol and ether. It has a faint alkaline reaction, and easily combines with the acetic and other acids, forming soluble salts. It has a hot, acrid taste, without any bitterness. Strong nitric acid gives to it a light red, turning to an ochreous, colour. Diluted sulphuric acid, when heated with the powder, or a residue containing veratria, produces an intense crimson-red colour. Veratria differs from colchicina in not being very soluble in water, and in the action of strong nitric as well as of diluted sulphuric acid.

Oil of Turpentine.

The few cases in which this liquid has produced any noxious symptoms have occurred among children. From these it appears to have rather the effects of a neurotic (narcotic) than an irritant poison. In a dose of three drachms it has produced intoxication. A dose of a table-spoonful caused in a child aged eighteen months, symptoms bearing a strong resemblance to those occasioned by an overdose of opium, although they were not so rapidly manifested. (See case by Mr. Johnson, 'Med. Times,' Oct. 11, 1851, page 380.) In three hours there was complete insensibility, with stertorous breathing, strongly contracted pupils, rapid and weak pulse, coldness of surface, paleness of the countenance, general relaxation of the muscles, and occasional convulsive movements. In no instance yet recorded has this oil caused death. A case of recovery in an infant that had swallowed four ounces is described in another work ('On Poisons').

A case in which this liquid was criminally administered to an infant, was the subject of a trial at the Central Criminal Court, December 1856, *Reg.* v. *Rodanbosh*): it did not destroy life, but the child suffered for some time from the effects. The defence was, that the oil of turpentine was poured down the child's throat by the mother with a view to cure it of a cough! She was acquitted.

Oil of Tar.

This is a powerful vegetable irritant. In 1832, about ten drachms of it caused the death of a gentleman, to whom it had been sent by mistake for a black draught. The druggist who sent it was tried for manslaughter, but acquitted. Its irritant properties are owing to creasote, carbolic acid, and other compounds.

MOULDY BREAD.

There is a common article of food, namely *bread*, upon the occasionally noxious effects of which some observations have been made by toxicologists. (In the 'Annales d'Hygiène, 1843, pp. 35 and 347, will be found communications on this subject from MM. Guérard, Chevallier, and Gaultier de Claubry; also in the same journal, 1852, vol. 1, p. 350.) The changes which take place in the decomposition of flour and bread, and the production of various kinds of *mouldiness*, are here investigated, together with the effects of such bread upon the animal system. It would appear that in some parts of France the peasantry manifest no repugnance to the eating of *mouldy bread*; and that in many instances the practice appears to be attended with no ill effects. The nature of the mould produced, however, is subject to great variation, and it is not improbable, as M. Chevallier suggests, that in some cases a poisonous principle is actually developed. In two instances of children, who had partaken of mouldy rye bread, symptoms resembling those of irritant poisoning supervened. The countenance was red and swollen; the tongue dry; the pulse quick; there were violent colics, with pain in the head, and intense thirst. Vomiting and purging supervened with a state of collapse, but the children eventually recovered. These symptoms were ascribed to the production of '*mucor mucedo*' in the bread. In 1829, alarming effects having followed from the use of a certain kind of bread in Paris, M. Barruel was called upon to determine whether any irritant poison had or had not become accidentally intermixed with it. The bread was simply in a mouldy state; there was no trace of poison. It is unnecessary to enter further into this subject; the facts adduced, together with experiments performed on animals, show that bread, in a state of mouldiness or decay, may not only produce symptoms of poisoning, but actually cause death; and as it is impossible to distinguish the noxious from the innoxious kind of mould, the use of all bread in such a condition should be avoided.

Even *fresh bread* may occasionally seriously affect the body. The *brown bread* of London has been known to produce giddiness, lethargy, and other unpleasant symptoms, indicative of an affection of the brain and nervous system. This has been ascribed, with some probability, to the accidental presence of Darnel seeds in the corn.

CAROB OR LOCUST BEAN.

The locust beans or *locust nuts* have been much used in England for the fattening of cattle; but in a few cases in which they have been eaten by children, they are supposed to have occasioned violent irritation; and in one case (March, 1857), a boy, æt. 10, died in about sixteen hours, apparently from their poisonous action on the body. The chief symptoms during life were pain in the head, vomiting, and purging, with clenching of the hands, and a spasmodic action of the muscles of the face. On inspection, the stomach and intestines were found much inflamed. The viscera were carefully examined by Mr. Watson, of Bolton, but no mineral poison could be detected. Another fatal case, as it was alleged, from eating locust nuts, occurred subsequently in London, and was the subject of an inquest before Mr. Wakley. The facts at present scarcely admit of an explanation. (See 'Med. Times and Gaz.,' March 14, 1857.) The nuts contain no substance injurious to animals, and as it is alleged that many human beings have eaten them with impunity, the effects produced in the above cases, may have been dependent on idiosyncrasy. (p. 135.)

ANIMAL IRRITANTS.

CHAPTER 23.

ANIMAL IRRITANTS—CANTHARIDES OR SPANISH FLIES—SYMPTOMS AND EFFECTS—ANALYSIS—POISONOUS ANIMAL FOOD—FISH—MUSSELS—CHEESE—SAUSAGES—DISEASED FLESH OF ANIMALS—TRICHINIASIS.

CANTHARIDES. (SPANISH FLIES.)

Symptoms and Effects.—Cantharides are not unfrequently administered, either in the state of powder or tincture, for the criminal purpose of procuring abortion. When taken in *powder*, in the dose of one or two drachms, it gives rise to the following symptoms: a burning sensation in the throat, with great difficulty of swallowing, violent pain in the abdomen, with nausea, and vomiting of bloody mucus: there is also great thirst and dryness of the fauces, and in a few cases observed by Mr. Maxwell, salivation was a prominent symptom. As the case proceeds, a heavy dull pain is commonly experienced in the loins, and there is an incessant desire to void urine, but only a small quantity of blood or bloody urine is passed at each effort. The abdominal pain becomes of a violent griping kind. Purging supervenes, but this is not always observed: the matters discharged from the bowels are mixed with blood and mucus, and there is often tenesmus (straining). In these, as well as in the vomited liquids, shining green or copper-coloured particles may be commonly seen on examination, whereby the nature of the poison taken, if it has been taken in powder, will be at once indicated. After a time, there is severe priapism, and the genital organs are swollen and inflamed both in the male and female. In one instance, observed by Dr. Pereira, abortion was induced, probably owing to excitement of the uterus, from the severe affection of the bladder: for there is no proof that this substance acts directly on the uterus to induce abortion. With respect to the aphrodisiac propensities said to be caused by cantharides, these can seldom be excited in either sex, except when the substance is administered in a dose which would seriously endanger life. When the case proves fatal, death is usually preceded by faintness, giddiness, and convulsions. The *tincture* of cantharides produces similar symptoms:—they are, however, more speedily induced, and the burning sensation and constriction of the throat and stomach are more strongly marked: this symptom is often so severe as to render it impossible for the individual to swallow; and the act of swallowing gives rise to excruciating pain in the throat and abdomen. This poison has been in some cases wantonly used, and with great danger to life, with a view of exciting sexual feelings in females. The doses in which it has been given have been such as to cause symptoms of irritant poisoning. In Nov. 1859, six female servants in a gentleman's family, as well as the master and mistress, were attacked with all the symptoms of poisoning by cantharides. It appeared that the coachman of the family had, shortly before the occurrence, purchased an ounce of this poison; that he had put the cantharides into beer and coffee, and had thus poisoned the whole household. He was tried, but acquitted of any indictable offence, on the ground that his intent was not to murder. It was this case which led to an alteration in the law.

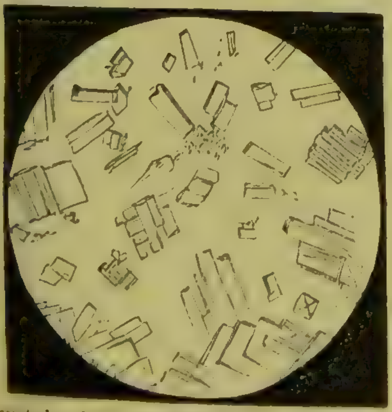
Appearances.—In one well-marked case of poisoning by this substance, the whole of the alimentary canal, from the mouth downwards, was in a state of inflammation. The mouth and tongue seemed to be deprived of their mucous membrane. The ureters, kidneys, and internal organs of generation were also inflamed. In another instance, in which an ounce of the tincture was swallowed, and death did not occur for fourteen days, the mucous membrane of the stomach was not inflamed; but it was pulpy, and easily detached. The kidneys were, however, inflamed. The brain has been found congested, and ulceration of the bladder is said to have been met with. There are few fatal cases reported, in which the appearances have been accurately noted; indeed, the greater number of those who have taken this poison have recovered. In a case which occurred to Mr. Saunders, death took place in about twenty-four hours. The deceased must have taken the greater part of half an ounce of cantharides in powder. The symptoms were such as have been above described. On inspection, the vessels of the brain were filled with dark-coloured blood, and the ventricles were distended with serum. Both lungs were highly engorged with dark-coloured blood. The gullet was partially inflamed, and there were patches of inflammation on the mucous coat of the stomach, which had become detached in several places. The same inflammatory appearance existed in the small intestines, in the folds of which the powder of cantharides was abundantly present. The vessels were distended, and the liver was engorged with dark blood. The gall-bladder was much distended with bile, and none of this secretion appeared to have passed into the bowels. The spleen and kidneys were highly congested; the ureters were inflamed; the bladder was contracted and empty, and its internal surface pale. The glittering of the particles of cantharides in the viscera during the inspection by candlelight, was very remarkable. ('Medical Times,' Feb. 3, 1849, p. 287.) Cantharides have no local action of a chemical nature. The poison is a pure *irritant*, and the effects observed on the stomach are entirely due to irritation and inflammation.

The quantity of this poison required to produce serious symptoms, or to destroy life, has been a frequent subject of medico-legal inquiry. Dr. Thomson represents the medicinal dose of the powder to be from one to three grains. On a late criminal investigation a medical witness stated, that one grain was the maximum dose, but this is an under-statement: according to Thomson it is *three grains*. The dose of the tincture is from ten minims gradually increased to one fluid-drachm,—of the powder from *one* to *two grains*. (Pereira, 'Mat. Med.' part 2, vol. 2, p. 754.) Doses above this, whether of the powder or the tincture, are likely to be injurious, and to give rise to symptoms of poisoning. On a trial which took place at Aberdeen, in 1825, it appeared that a drachm of the powder had been administered: severe symptoms followed, but the person recovered. Dr. Dyce, the medical witness, said he had given ten grains of the powder as a medicinal dose. In three cases, observed by Mr. Maxwell, a drachm of the powder mixed with six ounces of rum was taken by each person: they were robust, healthy negroes, they suffered severely, but recovered in about ten days: in these cases, irritation of the urinary organs did not appear until after the men had been bled.

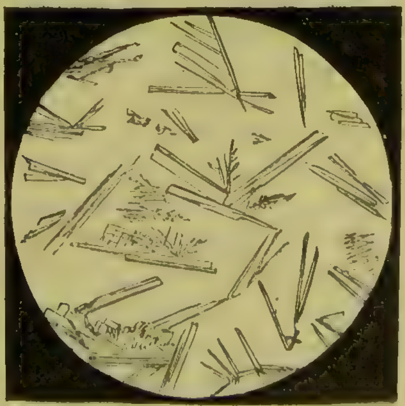
Fatal Dose.—The *smallest quantity* of the powder which has been known to destroy life, was in the case of a young female, quoted by Orfila,—the quantity taken was estimated at *twenty-four grains* in two doses. She died in four days; but as abortion preceded death, this may have been concerned in accelerating that event. Her intellect was clear until the last. In one instance a man recovered after having taken twenty grains of the powder ('Ed. Med. and Surg. Journal.' Oct. 1844); and in another, after having taken *two drachms* ('Med. Gaz.' vol. 42, p. 873.) An *ounce* of this tincture has been known to destroy life. It was taken by a boy, æt. 17, and he died in fourteen days. This, I believe, is the smallest dose of the tincture which has proved fatal. Four drachms and even six drachms have been taken; and although the usual symptoms followed, the parties recovered. The last case was the subject of a trial at the Central Criminal Court, in September, 1836. Six drachms of the tincture were administered to a girl, æt. 17: the medical witness was required to say whether half an ounce was sufficient to kill a person, as also what proportion of cantharides was contained in an ounce of the tincture; he said, five grains. One ounce of the tincture is equivalent to five and a half grains of the powder; but considering that the principle *cantharidine* is the substance on which the poisonous properties depend, it is not unlikely that the tincture varies in strength. A case is quoted by Pereira, from Dr. Hosack ('Mat. Med.' vol. 2, pt. 2, p. 750), in which it is said six ounces of the tincture were taken by a man without causing dangerous symptoms! This must have been an extraordinarily weak preparation: and probably the insects from which the tincture was made, contained little or no cantharidine. The same writer mentions a case within his own knowledge in which one ounce of the tincture caused serious symptoms. The powder cannot be so readily administered as the tincture, since a large portion of it floats for a time on any liquid with which it is mixed, and attracts attention by its peculiar appearance. At the Liverpool Lent Assizes, 1861 (*Reg.* v. *Wilkins*) a man was indicted for administering powdered cantharides to a female. The prisoner had mixed it with a cup of tea: the prosecutrix took a portion of the tea and suffered from vomiting and other symptoms produced by this substance: she skimmed a quantity of the powder from the tea, on which it floated, and its nature was then easily determined. The prisoner was convicted of the act of administration, but a serious question arose in reference to the intent. The jury found that he had administered the powder with the intent to excite the sexual passion of the woman, for which the new statute had not provided, as this makes the offence to depend only on the intent to injure, aggrieve, or annoy!

Chemical Analysis.—For the detection of *cantharidine* which forms only 1-250th part of the flies, it has been recommended to digest the suspected solid or the liquid contents of the stomach (evaporated to an extract) in successive quantities of ether, to concentrate these ethereal solutions by slow evaporation, and then observe whether the concentrated liquid applied to the skin of the lips produces vesication or not: the medical jurist being expected in such cases to make himself the subject of experiment. By this method Barruel discovered cantharides in some chocolate. ('Ann. d'Hyg.' 1835, vol. 1, p. 155.) For the detection of the powder, M. Poumet recommends that the suspected liquids, mixed with alcohol, should be spread on sheets of glass, and allowed to evaporate spontaneously to dryness. The shining scales will then be seen, on examining, by reflected light, either one or both surfaces of the glass. ('Ann. d'Hyg.' Oct. 1842.) As the powder is insoluble in water, ome portion of it may be obtained by washing and decantation. The sediment may be examined on a glass-slide with the microscope.

Cantharidine is a neutral crystallizable principle. I subjoin illustrations of its crystalline form, obtained by the spontaneous evaporation of its solutions in ether and chloroform:—



Crystals of Cantharidine from a solution in chloroform magnified thirty diameters.



Crystals of Cantharidine from a solution in ether magnified thirty diameters.

As ten grains of the powder contain only the 1-25th part of a grain, it will not be in the power of an analyst to extract cantharidine unless the powder is present in comparatively large quantity. The 1-100th of a grain of cantharidine dissolved in ether is said to possess vesicating properties.

Mr. Tichborne recommends, in place of ether, the use of chloroform for the separation of cantharidine from the tincture or from an alcoholic or aqueous extract of the contents of the stomach. He added a quantity of tincture equivalent to three grains of powdered flies (four drachms) to half a pint of wine: one ounce of chloroform was frequently shaken with this mixture and left in contact with it twenty-four hours. The chloroform was then separated by a funnel and filtered; it was allowed to evaporate spontaneously in a watch-glass. A pellet of lint of the size of half a pea, pulled out, was moistened with a drop of olive-oil, and the residue in the watch-glass was taken up by it. It was placed upon the arm and covered with goldbeaters' skin. When taken off in three or four hours, the skin was very red, and, on wiping it with chloroform, a large vesicle was produced. ('Chem. News,' Feb. 14, 1863, p. 78.) The quantity of cantharidine here detected, amounted to only the 1-80th part of a grain. This mode of operating is certainly preferable to the use of ether, as cantharidine is less soluble in ether than in chloroform. I have ascertained by experiment that half an ounce of the tincture of cantharides, will yield to chloroform a crystallizable principle, having the characters assigned to cantharidine. In practice it will be found advisable to concentrate the liquid as much as possible before adding the choloroform, and to employ two measures of chloroform for one measure of the liquid for analysis.

The evidence of the presence of cantharides, or of their having been taken, is necessary to support a criminal charge; for however unambiguous the symptoms produced by this poison may appear to be in its peculiar effects on the generative and urinary apparatus, the medical jurist should be aware that similar symptoms may proceed from disease. An important case of this kind has been reported by Dr. Hastings. ('Med. Gaz.' vol. 12, p. 431.) A young lady was suddenly seized with vomiting, thirst, pain in the loins, strangury, and considerable discharge of blood from the urethra: the generative organs were swollen and painful. She died in four days. She was governess in a family, and there was some suspicion that she had been poisoned by cantharides. The stomach and the kidneys were found inflamed, and the bladder also; this contained about two ounces of blood. There was no trace of poison; and indeed, it was pretty certain, from the general evidence, that none could have been taken.

NOXIOUS ANIMAL FOOD.

Certain kinds of animal food are found to produce, occasionally, symptoms resembling those of irritant poisoning. In some instances this poisonous effect appears to be due to idiosyncrasy; for only one person out of several may be affected. These cases are of importance to the medical jurist, since they may give rise to unfounded charges of criminal poisoning. In the absence of any demonstrable poison, we must test the question of idiosyncrasy by observing whether more than one person is affected, and whether the same kind of food, given to animals, produces symptoms of poisoning. If, with this latter condition, several persons are affected simultaneously, we cannot refer the effects to idiosyncrasy; they are most probably due to the presence of an animal poison. Among the articles of food which have caused symptoms of irritant poisoning, may be mentioned,—

Poisonous Fish. Mussels.—Of all the varieties of shell-fish, none have so frequently given rise to accidents as the common mussel. The symptoms which it produces, are uneasiness and sense of weight in the stomach, sensation of numbness in the extremities; heat, dryness, and constriction in the mouth and throat; thirst, shivering, difficulty of breathing, cramps in the legs, swelling and inflammation of the eyelids, with a profuse secretion of tears, and heat and itching of the skin, followed by an eruption resembling nettle-rash. These *symptoms* are sometimes accompanied by colic, vomiting, and purging. They may occur within ten minutes or a quarter of an hour ; but their appearance has been delayed for twenty-four hours. There is generally great exhaustion and debility. These symptoms have proceeded from the eating of not more than ten or twelve mussels. Two cases, reported by Dr. Christison, proved fatal, the one in three, and the other in about seven hours. In general, however, especially when there is free vomiting, the patients recover. In the inspection of the two fatal cases above mentioned, no appearance was found to account for death. A case in which two mussels produced, in a boy aged ten, alarming symptoms, followed by an eruption resembling scarlatina and nettle-rash, will be found elsewhere reported ('Guy's Hosp. Reports,' Oct. 1850, p. 213). In July, 1860, a number of persons living at Tralee were poisoned under the following circumstances. A woman picked up some mussels which she found at the bottom of the basin of a ship-canal. She distributed them among her neighbours, and during the night, twenty-one persons who had eaten them, were attacked with symptoms of poisoning. Three children died, and six individuals were placed in imminent peril. The rest were soon out of danger. Eight of the twenty-one persons attacked were adults. ('Med. Times and Gazette,' July 28, 1860.) In October, 1862, an accident occurred at Liverpool in which a woman died in about four hours, after having eaten some mussels taken from a ship in the docks. There was severe pain and vomiting among the symptoms, which generally resembled those of arsenical poisoning. Several other persons were made seriously ill, but recovered. Although the vessel was not sheathed with copper or yellow metal, it was coated with a green pigment, of which arsenic may have been a constituent.

The poisonous action of mussels can be referred neither to putrefaction nor disease; nor in all cases to idiosyncrasy, since in one instance those mussels only which had been taken from a particular spot were poisonous; all persons who partook of them suffered, and a dog to which some of them were given, was killed. From a case which occurred to M. Bouchardat, it would appear that copper is sometimes present, and may be the cause of the poisonous effects. Two women were poisoned by mussels, and he found on analysis sufficient copper in the fish to account for the symptoms of irritation from which they suffered. ('Ann. d'Hyg.' 1837, vol. 1, p. 358.) Copper is not, however, present in all cases, and it is therefore probable that there is in some, if not in all instances, an *animal poison* present in the fish. (See 'Ann. d'Hyg.' 1851, vol. 1, p. 387, vol. 2, p. 108.) *Oysters* and *periwinkles* have occasionally given rise to similar symptoms. *Salmon*, sold in the state of pickled salmon, or even *herrings* salted, may also act as irritants: this may be due to the fish being partially decayed before it is used, or to the noxious effects of the pickle. For some remarks by Dr. Hamilton on the poisonous properties of fish, see the Pharmaceutical Journal, Jan. 1853, p. 344.

Cheese.—The symptoms produced by cheese have been those of irritant poisoning. The nature of the poison is unknown. In some cases the irritant property is undoubtedly due to a putrefied state of the curd, or to the production of an irritant oil. Again, it has been supposed that the poison is occasionally derived from certain vegetables on which the cows feed. In 1858 a case was referred to me for examination, in which twenty-five persons had suffered from vomiting and purging more or less violent, owing to their having partaken of cheese. The only articles of food taken in common were bread, beer, and cheese. The bread and beer were excluded from any suspicion of containing poison. All the persons recovered. On a close examination of the cheese I found it to be strongly acid: it had an offensive musty smell, and yielded a quantity of acrid oil to ether. It had not been properly pressed, and the casein had undergone a chemical change. The ashes yielded copper and lead in traces. The cheese had acquired irritant properties, not from the presence of any poisonous matter added to it, but from partial decay. There was abundant evidence that cheese from the same dairy had been eaten without causing any injurious symptoms. This negative evidence, however, is quite consistent with one cheese acquiring noxious properties. We must not lose sight of the fact that cheese may actually contain poison mixed with it through ignorance. Orpiment or chromate of lead may be used as colouring, and the discovery of such mineral substances would at once account for the irritant effects. (See Pharmaceutical Journal, Aug. 1862, p. 89.) The milk and cheese of some of the North American provinces, is said to be occasionally rendered poisonous by the fact that cows pasture at certain seasons on vegetables of a noxious kind.

Sausage Poison.—The symptoms caused by *sausage-poison* partake of a narcotico-irritant character: they are very slow in appearing.—sometimes two, three, or four days may elapse before they manifest themselves. This poison is of a formidable kind: its effects have been chiefly observed in Germany. In the Medical Gazette for Nov. 1842, there is an account of the cases of three persons, who had died from the effects of liver-sausages, which had been made from an apparently healthy pig, slaughtered only a week before. The inspection threw no light on the cause of death. The poisonous property was supposed to depend on a *partial* decomposition of the fatty parts of the sausages. It is said, that when extremely putrefied, they are not poisonous. In a case in which I was consulted, a few slices of a German sausage, evidently of old manufacture, but not putrescent, caused the death of a child, with violent symptoms of irritation of the stomach and bowels. I examined a portion of the sausage: it contained no poisonous matter which admitted of detection. The fatty portions were rancid, and the lean portions very dry. There was no doubt, however, that it had been the cause of the symptoms and death of the child. Dr. Tripe has published a complete account of the effects produced by sausage poison ('Brit. and For. Med. Rev.' Jan. 1860, page 197). It appears that in November 1859, sausages made and sold by a pork-butcher, at Kingsland, were eaten more or less by sixty-six persons, of whom sixty-four were attacked with violent symptoms in from three and a half to thirty-six hours subsequently to the meal. One case only proved fatal, on the seventh day. No symptoms appeared in this man until after the lapse of six hours. It seems that he had eaten one of the sausages raw and three cooked. He was attacked with severe vomiting, and purging followed by shivering: there was pain in the abdomen: violent headache and great prostration. The pulse was feeble and quick, and there was delirium. These symptoms underwent a remission, but he had a relapse, became comatose, and died on the seventh day. Latterly, he chiefly complained of pain in the bowels. Dr. Letheby found, on inspection, no signs of inflammation or of the action of an irritant in the stomach. The small intestines were much inflamed at the lower end, and the gall-bladder was distended. The other organs were healthy. The viscera contained no vegetable or mineral poison. The sausages were made with heifer-beef, pork-fat, sage, and pepper. There was no evidence of anything noxious about them, and a chemical analysis yielded nothing of a poisonous nature. There could, however, be no doubt that the sausages had caused the symptoms and death;

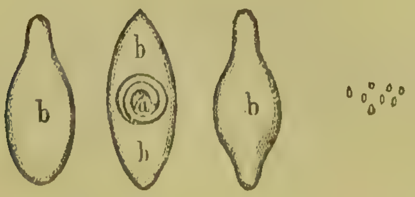
the food in this case acting as a narcotico-irritant poison. Other persons suffered from burning in the throat and stomach, followed by vomiting and purging; then giddiness or confusion in the head, and in some there was delirium. In the man who died, the delirium was well marked, and the eyes were red. In those persons who recovered, the noxious animal matter was probably early thrown off by vomiting and purging. (See 'Trichiniasis,' p. 278.)

Pork. Bacon.—These common articles of food occasionally give rise to symptoms so closely resembling those of irritant poisoning, as to be easily mistaken for them. In some cases, the effect appears to be due to idiosyncrasy; but in others it can be explained only by supposing the food to have a directly poisonous action. The noxious effects of pork have been particularly shown by the cases published by the late Dr. Mac-Divitt. ('Ed. Med. and Surg. Jour.,' Oct. 1836.) As pork is sometimes salted in leaden vessels, lead may be found in it: but fresh pork has been observed to have a noxious action. In January, 1864, Mr. Kesteven met with a case in which all the members of a family were attacked with symptoms of irritant poisoning, after eating a leg of pork. The principal symptoms were nausea, vomiting, griping pains in the abdomen, and purging: but dogs and cats fed upon the meat did not appear to suffer. Other portions of the animal from which the leg was taken, were eaten by other families, and no symptoms of poisoning were produced. I examined the fatty portion of the food without discovering any trace of the ordinary poisons. The effects could, therefore, only be referred to some change in this particular joint.

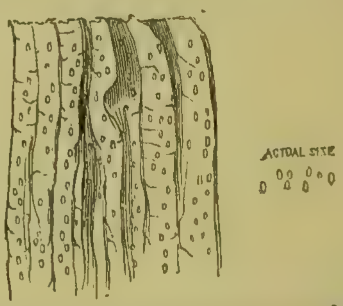
These cases of poisoning by animal food have of late been very fully examined by Mr. Simon and Mr. Gamgee. These gentlemen have traced the injurious efforts of pork to a diseased condition of the pig, owing to the animal having been fed on improper food. The term measly pork is now very well known to consist in a diseased condition of the flesh of the animal, in which it is filled with a parasite called cysticercus, which is believed to be the larva of the tapeworm. This parasite undergoes full development when in the shape of food it reaches the human intestines. Mr. Gamgee expresses his confidence that there are between 40,000 and 50,000 measly pigs in Ireland, most of which are sent to Great Britain for consumption; and his impression is that for every measly pig in the kingdom, there is at least one human being affected with tapeworm. These parasites may not directly kill a person who eats this noxious food, but they favour the development of fatal disease. He also remarks that a microscopical thread-worm, the *trichina spiralis*, brings the muscular flesh of swine into a state in which a small quantity of it eaten raw, or in an imperfectly cooked state, may suffice to destroy life. As regards the possible ill effects from consuming, in a well-cooked state, the flesh of animals afflicted with *anthrax* or carbuncular fever, evidence is still imperfect, but he believes that human life may be endangered by it. An opinion has been expressed that boils and perhaps other like affections are caused in the human subject by the consumption of diseased meat. According to Mr. Gamgee, at a convict establishment where diseased cattle are eaten in large quantities, and especially cattle afflicted with lung-disease, as many as 40 and 50 cases of boils and carbuncles occur in a month among 1,500 convicts. (Simon's 'Annual Report,' 1863.) This lends support to the theory that diseased animal food is highly favourable to the production of carbuncular disease.

There is reason to believe that, in spite of every precaution, a large amount of diseased and unwholesome meat is sold to the public, and that of the various kinds of flesh used as food none is so subject to disease as pork. Some of the changes which it undergoes are of a microscopical character, and are not likely to be noticed. This subject has attracted the attention, not only of the Board of Health in England, but of the Governments of France and the German States, with a view to the protection of public health. For a full account of the diseases affecting the flesh of the pig, their mode of production, and the prevention of accidents, I must refer the reader to papers by M. Delpech, in the 'Annales D'Hygiène,' 1864, vol. 1, pp. 5, 241 ('De la Ladrerie du porc,' &c.) It has been clearly shown that the parasites found in the flesh of this and other animals, are not easily killed by boiling, roasting, or smoking, and that those are liable to suffer the most, who habitually eat the raw or partly-cooked flesh. The flesh of the pig containing cysticercus, presents in the cooked state the following appearances. When boiled it is paler than wholesome meat: it appears dryer in patches, and the muscular fibres are more separated than usual. When these are opened, the parasites are seen in the interstices, appearing as opaque white spots of the size of a hemp-seed, and presenting much the same aspect as when living. The caudal bladder attached to their bodies disappears when the meat is thoroughly cooked, and the body of the animal then appears isolated in the middle of the muscular tissue. It is friable and breaks down easily under pressure with a crackling sound, owing to the presence of calcareous matter. In this state it does not appear to be necessarily productive of injury ('Ann. d'Hyg.' 1864, vol. 1, p. 249), although such food must be regarded as most unwholesome. All the members of a family were seized with vomiting, purging and syncope after having eaten a dish of pork. A medical man examined the meat, and found it full of cysticercus. A pork-butcher was accused of having sold bad meat, but it was proved to have been some cheap pork bought of a hawker of provisions ('Ann. d'Hyg.' 1864. vol. 1, p. 246.) If the cysticercus did not cause the symptoms in this case, the meat had undergone some change sufficient to impart to it irritant properties. These parasites occur in all the fleshy parts of the body. I have seen them in the human heart, as well as in the flesh of animals. My colleague, Mr. Hilton, first showed them to me in the living state, in the muscles of the thigh of a man, in 1834. They are not commonly found in the fatty portions of man and animals, and are less common in sheep and oxen than in pigs.

Trichiniasis.—The fatal malady, arising from the introduction of the trichina spiralis into the human body, has recently attracted much attention in France and Germany; and among others, Dr. Keller, of Darmstadt, has published some important facts illustrating the symptoms produced, and the mode in which this parasite causes death. Dr. Keller considers that it is a question well worthy of the attention of medical jurists, whether many cases of death from suspected irritant poisoning, in which no poisonous matter could be detected in the body, may not have been really due to trichina disease.



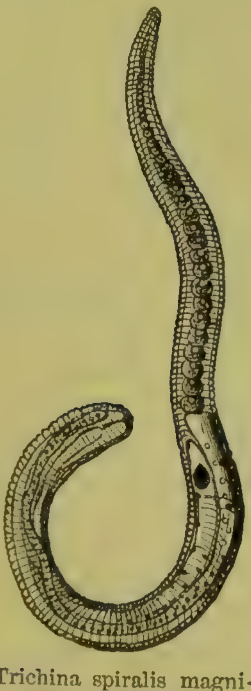
Magnified view of Trichina spiralis in its Capsule.
a The worm coiled.
b The capsules.



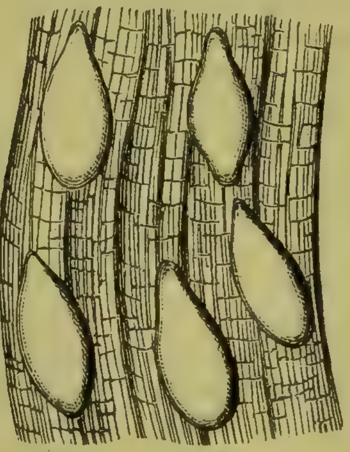
Trichina spiralis in the abdominal muscles of a man: natural size of the capsules containing the worm.

The trichina (from θρίξ, a hair) spiralis, a flesh-worm, is found chiefly in the course of the fibres of all the striped muscles of the trunk and limbs, most frequently on those of the front of the chest, neck, and abdomen. It has also been found on the muscular fibres of the heart and œsophagus. The parasites appear in the form of very small white ovoid bodies, or capsules, perceptible to the eye as white specks, in the midst of the muscular fibres, but only distinctly seen by the aid of a magnifying glass. The trichina, or worm, is coiled up in the centre of each oval capsule, the greater diameter of which is always parallel to the muscular fibre with which it is closely incorporated. The engraving at the foot of page 278, is taken from a preparation in the Museum of Guy's Hospital; it represents a portion of the abdominal muscles of a man, covered with trichinæ *in situ*, and as nearly as possible of the natural size. Other illustrations in the same page represent three of the capsules *b b b* magnified, with the trichina coiled up in the centre of one of them.

These parasites are frequently so numerous as to give to the red flesh a white speckled appearance. According to Dr. Keller, as many as 300,000 have been counted in half a pound of raw meat: and Dr. Pietra Santa affirms that one gramme (about sixteen grains) of diseased meat, may contain 6,000 trichinæ, each having from sixty to eighty embryos. ('Ann. d'Hyg.' 1864, vol. 1, p. 317.) The illustrations below present a magnified view of the capsules of trichina in muscular fibre from a drawing by Dr. Wilks, and an engraving of the flesh-worm itself, removed from its capsule, and magnified 100 diameters. This, which is taken from an engraving in Griffiths' 'Micrographic Dictionary,' shows the form and structure of the parasite. The worm is cylindrical, narrowed or pointed towards the anterior, while the posterior end is obtuse and rounded.



Trichina spiralis magnified 100 diameters.



Magnified view of Trichina spiralis in muscular fibre.

The actual size of the capsule has been variously stated. From an examination of two sets of specimens in the muscles of the throat and abdomen, I estimated the long diameter to be the 1-50th of an inch, and the short diameter 1-100th. The worm itself, is said to be the 1-30th of an inch in length. The capsules are remarkably uniform in size. They are built up at the expense of the muscular structure by which they are surrounded.

The history of this animal has been given by numerous pathologists. ('Hodgkin's Lectures on Morbid Anatomy,' 1836, vol. 1, p. 211.) A full description of its anatomy and habits by Dr. Bristowe and Mr. Rainey will be found in the 'Transactions of the Pathological Society' for 1853-4, p. 274. More recent accounts of its influence on health by Dr. Pietra Santa, have been published in the 'Ann. d'Hyg.' 1864, vol. 1, p. 305 ('La Trichina spiralis'), and by Drs. Schultze and Lücke in Casper's 'Vierteljahrschrift für gerichtliche Medicin,' 1864, No. 1, p. 103, and No. 2, p. 269. Dr. Lücke's paper is of especial interest as its title 'Die Trichinen vor dem Forum' implies, since it points to the medico-legal bearings of the subject, and the possible danger of confounding the ravages of this parasite, with the obscure effects produced in certain forms of chronic irritant poisoning.

From these researches, it is now clearly established, that the trichina is a viviparous parasite, which passes the greater part of its existence, in the chrysalis state, in the muscular system, until, by the consumption of this muscle as food, it finds in the stomach and intestines of another warm-blooded animal, a favourable medium for its full development into an intestinal worm, According to Virchow and Zenker, the trichina not only frequently presents itself in the human organism, but this organism is most favourable to its development. The period of incubation of the chrysalis in the stomach and bowels of man or of warm-blooded animals, is from six to eight days; and during this time it there thrives and propagates to an almost incredible extent. Dr. Keller states that in three or four days the females produce 100 or more young ones, which begin on the sixth day to leave the parent animal; and he estimates that in a few days after the ingestion of half a pound of meat, the stomach and intestinal canal of a person may contain thirty millions of these minute worms. M. Herbst found the muscles of two dogs which had been fed upon parts of a badger containing worms, to be loaded with these parasites. When once introduced into the stomach and intestines, the worms leave their capsules, become free, and produce young, which migrate through the walls of the intestines into the muscles: there they become encysted, and are ultimately found appropriating and destroying the muscular substance to a greater or less extent. The sudden liberation of a large number of these worms causes irritation and inflammation in the bowels, attended by peculiar symptoms resembling in some respects those of poisoning.

It is worthy of note that trichinæ are more frequently found in pork and articles of food derived from it, than in any other kind of meat. Measly pork appears to be sometimes of a trichinous character. Further, the vitality of the parasites is not destroyed unless the meat, or other substances in which they are located, has been subjected to a temperature equal to that of boiling water for a sufficient time to ensure that every particle has been exposed to this degree of heat. Salting and smoking, or partial cooking, is not sufficient to destroy the worms in all parts of the food, and they have even been found living in putrefied meat. This may serve to account in some cases for the serious symptoms which have followed the use of pork as food, also of bacon, sausages, and German sausages, which are generally made of raw ham.

The symptoms produced by the use of such food are, in the first stage, those of intestinal irritation, loss of appetite, sickness, pain, general weakness of the limbs, with diarrhœa, swelling of the eyelids and of the joints, profuse clammy perspiration, and a wasting fever, sometimes of a typhoid character. Death is either the result of paralysis (from destruction of the muscular fibres), or of peritonitis and irritative fever. During the perforation of the coats of the intestines by these worms, the mucous membrane becomes irritated and inflamed: pus is formed on its surface, and bloody evacuations are sometimes passed. No case is known in which trichiniasis, after having once declared itself, was arrested by medical treatment.

The noxious effects of this food on human beings are well illustrated by a series of cases which occurred at Hettstädt, in the Hartz mountains, in 1863. (' British Med. Journal,' Jan. 16, 1864, p. 75.) One hundred and three persons partook of smoked sausages made from a pig affected, as it turned out, with trichinous disease. The sausages were fried, and served for dinner in the usual way. On the following day, several persons who had partaken of this food were attacked with severe pain in the bowels, purging, loss of appetite, great prostration of strength, and fever. The number of persons attacked, rapidly increased : symptoms of peritonitis and pneumonia manifested themselves, and these were followed by paralysis of the intercostal muscles, and of the muscles in front of the neck. Eighty-three persons died from the effects of this noxious food, and the remainder were seriously injured in health. The remnants of sausage and of pork not eaten at this festival were examined, and were found to be literally swarming with encysted trichinæ. (See Casper's 'Vierteljahrschrift,' April 1864, p. 286.) The writer in the above journal, affirms that this parasitic disease does not attack sheep, oxen, or horses, and that beef is the safest of all descriptions of food, as no parasites have ever been discovered in it. They have not been found in the blood of animals whose muscles are liable to their attacks.

Dr. Reyber relates that in the year 1862, a series of cases of illness to the number of thirty occurred in Plauen, as the result of the use of pork containing trichinæ. Among the symptoms were great languor, loss of appetite, fever and pains in the muscles of the arms and legs. The effects spread like an epidemic. A female patient under Professor Virchow, died, at Dresden, with typhoid and rheumatic symptoms. When the body was inspected, trichinæ were found in her muscles. On inquiry, it was found that, four weeks before, a diseased pig had been killed and eaten in the town in which she resided; the butcher that killed it suffered, but this woman alone died from the effects. (' Ann. d'Hyg.' Oct. 1863, p. 471.) Pietra Santa relates that, at a nuptial festival at Wiesbaden, twenty persons partook of the food placed on the table. In the evening, the bride was suddenly seized with symptoms of poisoning, and in spite of medical assistance, died in a few hours. The bridegroom himself suffered from similar symptoms, and died after two days' illness. The other guests were not seriously affected. A physician-expert, who examined the case, found trichinæ in the body of the deceased, as well as in certain articles of food prepared from pork, which had been served at the table (' Ann. d'Hyg.' April 1, 1864, p. 321.) The fact that only two out of the party, suffered from symptoms resembling poisoning, and that one died rapidly, was calculated to excite grave suspicion. Sudden deaths from trichinous food are not common, and it is to be regretted that this case is not given with fuller details. The real cause of death in this instance, does not appear to have been clearly traced to the trichinous food.

Although little has been heard of trichinous disease in England, it appears to have been prevalent in Germany. Among the official notices recently published by the Prussian Government, is one which points out the danger arising from the use of pork in a diseased state, and warning those who sell it to the public, of the penalties which they thereby incur. (Casper's 'Vierteljahrschrift,' July 1863, p. 177.) Under this notice, it is stated in addition to the cases above given, that in 1862, thirty-eight persons in Kalbe, suffered severely from the use of such food, and of these, eight died from the effects.

Dr. Schultze refers to other groups of cases, which, however, do not appear to have been attended with great fatality. In Magdeburg, Neustadt, and Buckau, over a period of five years, 1858-62, from three to four hundred cases of illness were traceable to this cause. ('Die Trichinen Krankheit,' Casper's 'Vierteljahrsch.,' April 1864, p. 278.) In Burg more than fifty persons suffered, and eleven died. Other fatal cases have been reported. For these I must refer the reader to Dr. Schultze's paper. In February 1864, a whole family was poisoned at New York, and one member died from eating part of a ham, which, on microscopic examination, was found to be full of the trichina spiralis. Death was referred by the medical attendant to this cause.

It is probable that some unexplained cases of death from irritation of the stomach and bowels, simulating chronic irritant poisoning, may have been the result of eating food containing trichina spiralis. Medical men have been unable to group the symptoms under any known form of disease, while the marks of irritation and inflammation in the mucous membrane of the bowels have given strength to the supposition that poison must have been taken by the deceased, although chemical analysis had failed to show the presence of any ordinary poison in the fluids and solids of the body. In the course of many years' practice, I have met with several cases of this description, and there has been sometimes manifested a disposition to doubt the accuracy of chemical analysis. Dr. Lücke has related a series of fatal cases which occurred in 1845, attributed at the time to poison, which as he suggests were most probably caused by the use of trichinous food. (Casper's 'Vierteljahrschrift,' January 1864, p. 102.)

As means of distinction from irritant poisoning may be pointed out the long time which commonly elapses between the taking of the food and the commencement of the symptoms. The pain, vomiting, and purging are comparatively slight: the pain is in the bowels rather than in the stomach, and peritonitis, pneumonia, and fever are not commonly results of the action of irritant poisons, while they appear to be constant symptoms in trichiniasis. The absence of ordinary poison in the food, in the urine, and the evacuations, at any stage, may also be taken as conclusive evidence against irritant poisoning in its usual form.

In suspected cases, a new method of research must be added to those already in use. If any of the food can be obtained, this must be examined for the parasite by the aid of the microscope. If the case proves fatal, the voluntary muscles of the deceased must undergo a similar examination.

Putrescent Food.—The effects of disease on animal food must not be confounded with those which result from decay or putrefaction. The flesh of the most healthy animal is rendered unfit for food when it has passed into a putrescent state. It is not merely unwholesome, but highly irritant, causing rapidly vomiting, purging, pain, and other symptoms of a severe kind. Fortunately these symptoms lead at once to the expulsion of the noxious food from the body, and the person then recovers: the young, the old, and the infirm may, however, be so prostrated by vomiting and purging, that they may sink from exhaustion. Animal matter in a state of partial decay, or in the transition stage of putrefaction, must be regarded as of a poisonous nature. Much of the cheap butcher's meat sold to the poor is in a state of decay, and is quite unfit for human food. In 1863, 114,000 pounds of diseased, and 76,000 pounds of putrid meat were seized and condemned in the City of London alone. In January 1851, the family of a surgeon near London, were all affected with symptoms resembling irritant poisoning, after having partaken of a hare which had been stewed in a clean earthen vessel. The surgeon informed me that on the second day, his wife was seized with vomiting and purging, giddiness, heat in the throat, and general numbness, with inflamed eyes. Other members of the family vomited, and in the course of a few days the symptoms disappeared. I examined the vomited matter, and found it to consist of portions of the hare partially digested, but in a state putrefaction, so that there was abundant evidence of sulphuretted hydrogen the liquid. There was no mineral poison of any kind, although the mptoms, it will be observed, were rather like those occasioned by arsenic. had been remarked by the family, that a silver spoon, which had been used serving out this unwholesome food, was turned of a brown colour, no ubt from the chemical action of sulphuretted hydrogen; and this may be ken as a good domestic test of the putrefied condition of such food. Nature nerally applies an appropriate remedy, in the fact that the food itself proces copious vomiting and purging.

Cases of this kind must be distinguished from those in which *poisoned game* sold to the public. The game may be quite free from putrefaction, but xious from the poisoned grain which may have caused death. It is a very mmon practice to steep grain in a solution of arsenic, previous to sowing, d pheasants, partridges, and other birds may be accidentally destroyed by ting the grain. In some instances, grouse and other game are maliciously stroyed by the laying of corn, saturated with arsenic or other poisons, in the calities where the birds abound. There is no law to prevent the sale of isoned game by poulterers, and there is no precaution which can be taken the purchasers, except by observing whether the birds have or have not en shot. (See on this subject, 'ON POISONS;' also a letter by Dr. Fuller, Med. Gaz.' vol. 42, p. 1036.)

Mr. Taylor, of Romsey, has directed attention (Sept. 1862) to the serious mptoms produced by *Canadian partridges* eaten as food. A lady who had rtaken of this food was, in about two hours and a half, attacked with the llowing symptoms. She had sickness, and became insensible; the skin was ld, and no pulse could be felt. She was in a hopeless state for some hours, d only slowly recovered. The birds were quite fresh, having been packed ice. In another case, there were similar symptoms with constriction of e throat and great pain. Animals were made ill by this food. It was lieved that, in these cases, the birds had not been killed by poison, but that eir flesh had been rendered poisonous by some vegetable which they had ten.

NEUROTIC POISONS.

(NARCOTIC OR CEREBRAL POISONS.)

CHAPTER 24.

IUM—SYMPTOMS—APPEARANCES—ITS ACTION ON INFANTS—POISONING BY POPPIES —BY OPIATE COMPOUNDS—MORPHIA AND ITS SALTS—PROCESS FOR DETECTING OPIUM AND ITS PRINCIPAL CONSTITUENTS IN ORGANIC MIXTURES.

OPIUM.

ymptoms.—The symptoms which manifest themselves when a large dose of ium or its tincture has been taken, are in general of a uniform character. ey consist in giddiness, drowsiness, a strong tendency to sleep, stupor, suceded by perfect insensibility, the person lying motionless, with the eyes osed as if in a sound sleep. In this state he may be easily roused by a loud ise, and made to answer a question: but he speedily relapses into stupor. a later stage, when coma has supervened with stertorous breathing, it will be difficult, if not impossible, to rouse him. The pulse is at first small, quick, and irregular, the respiration hurried, and the skin warm and bathed in perspiration, sometimes livid: but when the individual becomes comatose, the breathing is slow and stertorous; the pulse slow and full. The skin is occasionally cold and pallid. The pupils, in the early stage, are contracted; in the later stage, and when progressing to a fatal termination, they may be found dilated. In a case referred to me in 1846, one pupil was contracted and the other dilated. They are commonly insensible to light. The expression of the countenance is placid, pale, and ghastly: the eyes are heavy, and the lips are livid. Sometimes there is vomiting, or even purging; and, if vomiting takes place freely before stupor sets in, there is great hope of recovery. This symptom is chiefly observed when a large dose of opium has been taken; and it may then be, perhaps, ascribed to the mechanical effect of the poison on the stomach. The odour of opium is occasionally perceptible in the breath. Nausea and vomiting, with headache, loss of appetite and lassitude, often follow on recovery. In cases likely to prove fatal, the muscles of the limbs feel flabby and relaxed, the lower jaw drops, the pulse is feeble and imperceptible, the sphincters are in a state of relaxation, the pupils are unaffected by light, the temperature of the body is low, there is a loud mucous rattle in breathing, and convulsions are sometimes observed before death, but more commonly in children than in adults. One of the marked effects of this poison is to suspend all the secretions except that of the skin. Even during the lethargic state, the skin, although cold, is often copiously bathed in perspiration. It is a question yet to be determined, whether this may not be a medium by which the poison is principally eliminated. The contracted state of the pupils has been hitherto considered to furnish a valuable distinctive sign of poisoning by opium or the salts of morphia. In relying upon it, it is necessary to bear in mind the fact pointed out by Dr. Wilks, that, in apoplexy which is seated in the Pons Varolii, the pupils are also contracted. He describes two cases of this form of apoplexy which were mistaken for poisoning by opium in consequence of this state of the pupils. ('Med. Times and Gaz.,' 1863, 1, p. 214.)

These symptoms usually *commence* in from *half an hour* to *an hour* after the poison has been swallowed. Sometimes they come on in a few minutes, especially in children; and at other times their appearance is protracted for a long period. In a case reported by Dr. Skae, the person was found totally insensible in *fifteen minutes.* As we might expect, from the facts connected with the absorption of poisons, when the drug is taken in the *solid* state, the symptoms are commonly more slow in appearing, than when it is *dissolved* in water or alcohol. In a case which occurred at Liverpool, in August, 1863, communicated to me by Dr. Edwards, a lady took on an empty stomach, a large dose (supposed to have been one ounce and a half) of laudanum. No symptoms of narcotic poisoning appeared for four hours and a half, and life was protracted for twenty-two hours.

It has been frequently observed, on these occasions, that a person has recovered from the first symptoms, and has then had a relapse, and died. There is some medico-legal interest connected with this state, which has been called secondary asphyxia from opium, although there appears to be no good reason for giving to it this name. In December, 1843, a gentleman swallowed a quantity of laudanum, and was found labouring under the usual symptoms. The greater part of the poison was removed from the stomach by the pump, and he so far recovered from his insensibility as to be able to enter into conversation with his medical attendants; but a relapse took place, and he died the following night. The case of the *Hon. Mrs. Anson* (Jan. 1859), furnishes another illustration of this singular condition. This lady swallowed, while fasting, an ounce and a half of laudanum by mistake. In a quarter of n hour emetics were given, but she did not vomit for half an hour; and she as not treated medically for two hours and a half. The matter then drawn om the stomach had no smell of laudanum. She was quite unconscious, and ad lost the power of swallowing. After remaining in this comatose state for pwards of nine hours, the patient revived, the face became natural, the pulse eady, the power of swallowing returned, she was able to recognize her daugh- rs, and, although, in a thick voice, to give an account of the mistake she had ade. This state lasted about five minutes, the torpor then returned, she again nk into profound coma, and died fourteen hours after the poison had been ken. It is not improbable that, in these cases, death may be occasioned by the cumulation of the poison, carried by the absorbents into the system; *i. e.* the orphia may be more rapidly carried into the system than it is eliminated om it. A remarkable case illustrative of this *remittent* form of poisoning by ium has been published by Mr. Kirby. (‘Dubl. Med. Press,’ Dec. 24, 1845, 406.)

Appearances.—In a case which proved fatal in fifteen hours, the vessels of e head were found unusually congested throughout. On the surface of the re part of the left hemisphere, there was an ecchymosis, apparently pro- uced by the effusion of a few drops of blood. There were numerous bloody ints on the cut surface of the brain:—there was no serum collected in the ntricles. The stomach was quite healthy. Fluidity of the blood is men- oned as a common appearance in cases of poisoning by opium. There is so engorgement of the lungs: most frequently observed, according to Dr. ristison, in those cases which have been preceded by convulsions. (Op. cit. 732.) Among the external appearances there is often great lividity of the in. Extravasation of blood on the brain is rarely seen;—serous effusions the ventricles, or between the membranes, are sometimes met with. The omach is so seldom found otherwise than in a healthy state, that the inflam- atory redness said to have been occasionally seen, may have been due to cidental causes. When tincture of opium has been taken and retained on e stomach, increased redness of the mucous membrane may occasionally be oduced by the alcohol alone. In a case of poisoning by a large dose of cture of opium, Dr. Sharkey found the following appearances twelve hours er death:—the body warm and rigid; the stomach healthy, containing a antity of gruel-like fluid, without any smell of opium. The intestinal canal d all the other viscera were healthy. The veins of the scalp, as well as of e dura mater and sinuses, were gorged with blood; but there was no effusion any part of the brain. The contents of the stomach yielded no trace of orphia or meconic acid, but there was no doubt that death had been caused opium, taken on the previous night. (‘Med. Gaz.,’ vol. 37, p. 235.) A case s communicated to me by Dr. Ogston, which was the subject of a trial at e Aberdeen Autumn Circuit, in Sept. 1853, in which a child, aged six months, ed in a few hours from a dose of sixty drops of wine of opium. The brain s congested to a marked extent. Although the dose was comparatively large, l death rapid, there was no decided indication of the presence of opium in e stomach. From this account of the appearances in the dead body, it will seen that there is nothing but a fulness of the vessels of the brain, which n be looked upon as specially indicative of poisoning by opium, and even s is not always present. A congested condition of the brain, however, if exist, can furnish no evidence of poisoning when taken alone, since it is so quently found, as a result of morbid causes, in otherwise healthy subjects.

Quantity required to destroy Life.—The medicinal *dose* of opium, in *extract powder*, for a healthy adult, varies from half a grain to two grains. Five ins would be a very full dose. The medicinal dose of the *tincture* is from minims to one drachm,—as an average, from thirty to forty minims. The *smallest dose of solid opium* which has been known to prove fatal to an adult, was in a case reported by Dr. Sharkey, of Jersey. A man, æt. 32, died very speedily in a convulsive fit, after having taken two pills, each containing about one grain and a quarter of extract of opium. This quantity is equivalent to *four grains* of crude opium. ('Med. Gaz.,' vol. 37, p. 236.) The *smallest fatal dose of the tincture* in an adult, which I have found recorded, is *two drachms*. The case is reported by Dr. Skae. ('Ed. Med. and Surg. Journ.,' July, 1840.) The patient was a robust man, aged 56;—he swallowed the tincture at ten in the evening, and died under the usual symptoms on the following morning; the case having lasted only twelve hours. The quantity actually swallowed, however, appears to be involved in some doubt; for it is subsequently stated (p. 160) that *half an ounce* of laudanum may have been taken. Large doses of the tincture have frequently been taken without proving fatal. I have elsewhere recorded a case in which five ounces of laudanum were taken even without producing sleep, and the patient recovered. ('Guy's Hosp. Reports, Oct. 1850, p. 220.)

Action of Opium on Infants.—In connection with this subject, it is important for a medical jurist to bear in mind that *infants* and young persons are liable to be killed by small doses of opium; they appear to be peculiarly susceptible of the effects of this poison. Dr. Ramisch, of Prague, met with an instance of a child, four months old, that was nearly killed by the administration of one grain of Dover's powder, containing only the tenth part of a grain of opium;—the child suffered from stupor and other alarming symptoms. The following case occurred in June 1822. Four grains of Dover's powder (containing less than half a grain of opium) were given to a child four years and a half old. It soon became comatose, and died in seven hours. Death was referred to inflammation of the throat, and the jury returned the usual unmeaning verdict of 'Died by the visitation of God;' but there was no doubt, from the evidence, that death was caused by the opiate medicine. Dr. Kelso met with an instance in which a child, nine months old, was killed in nine hours by four drops (minims?) of laudanum, equal to only *one-fifth part of a grain* of opium; it was much convulsed before death. A case is referred to in the 'Medical Gazette,' in which two drops (minims?) of laudanum, equal to the *tenth part of a grain* of opium, killed an infant. The following is another illustration of the fatal effects of a similar dose. A nurse gave to an infant, five days old, *two drops* (minims?) of laudanum, about three o'clock in the morning. Five hours afterwards the child was found by the medical attendant in a state of complete narcotism. It was revived by a cold bath, but a relapse came on, and it died the same evening, about eighteen hours after the poison had been given to it. On inspection, the brain and abdominal viscera were found in a perfectly healthy state, and there was no smell of opium in the stomach. ('Prov. Med. Journ.' Oct. 28, 1846, p. 519.) The fatal dose here, as in the former case, was equal to the tenth part of a grain of opium, and to only an infinitesimal dose of morphia! Dr. E. Smith has reported a case ('Lancet,' April 15, 1854), in which an infant, *seven days* old, died in eighteen hours from the effects of one *minim* of the tincture, or the *twelfth part of a grain* of opium. Coma with the usual symptoms was complete in half an hour. On inspection, the heart was found distended with black liquid blood: the lungs were collapsed but not congested. The brain was congested, but there was no effusion either into the ventricles or on the surface. (See also 'Med. Times and Gazette,' April 15, 1854, p. 386.) The smallest fatal case recorded (in an infant) was in a case communicated to me by Dr. Edwards of Liverpool (November, 1857). An infant, four weeks old, died from the symptoms of poisoning by opium, in seven hours after a dose of paregoric elixir, equivalent to *one-ninetieth* of a rain of opium, had been administered to it. With a knowledge of these cts, it is not surprising that infants are occasionally destroyed by opium nder circumstances in which an adult would not suffer. In December, 860, an inquiry took place at Chester respecting the death of a child, aged x weeks, under the following circumstances. A fomentation composed of udanum and gin was applied to the side of the mother, and the child was ut to the breast shortly afterwards. The child fell into a sleep from which did not awaken, and died, in spite of treatment, the next morning. The use of death was left obscure owing to the imperfect manner in which the quiry was conducted: but it is not improbable that the child drew a antity of laudanum into its mouth, sufficient to destroy life. ('Med. Times d Gaz.' Jan. 19, 1861, p. 70.) In some instances infants have been found manifest an astonishing power of recovery. Dr. Guy met with a case in hich an infant of six months recovered after having had administered to it n grains of Dover's powder, equal to one grain of opium ('Lancet,' June 8, 850); and Mr. Tubbs has informed me, that in a case which occurred in nuary 1852, an infant of nine months recovered under treatment from a se of two teaspoonfuls of laudanum, given by mistake. This quantity left evaporation four grains of an impure extract of opium. In 1860 a case as communicated to me in which an infant of between two and three onths old, recovered after *five grains* of opium had been given to it by istake for rhubarb. Dr. Hays met with a case in which a child not quite years old, swallowed a powder containing *seven and a half grains* of ium mixed with powdered chalk. The child was not seen until fourteen urs afterwards. It was at first excited: there had been no vomiting. The rcotism was at no time very profound: it gradually subsided, and at the d of three days the child had recovered! ('Am. Jour. Med. Sci.' April 59, p. 367.)

Period at which Death takes place.—It has been remarked, that most cases poisoning by opium prove fatal in from about six to twelve hours. They no recover from the stupor, and survive longer than this period, generally well; but from cases above related (see p. 284), it would seem that there y be a partial recovery, or a remission of the symptoms, and afterwards a apse. The symptoms, however, generally progress steadily to a fatal ternation, or the stupor suddenly disappears, vomiting ensues, and the person covers. Several instances are recorded of this poison having destroyed life from seven to nine hours. One has occurred within my knowledge, in ich an adult died in five hours after taking the drug prescribed for him by quack. Dr. Christison met with a case which could not have lasted above e, and another is mentioned by him which lasted only three hours. Mr. rwis, of Melton, communicated to me the case of an adult (November 63) which proved fatal in three hours and a half. Nearly two ounces laudanum had been taken: but there was no smell of opium in the mach when inspected thirty hours after death. Dr. Beck quotes a case ich proved fatal in two hours and a half. ('Beck, Med. Jur.' p. 873.) . Procter, of York, communicated to me the case of a female, æt. 50, o in January 1857, swallowed an ounce of laudanum of the pharcopœial strength, and died from the effects in less than *two hours.* ium was found in the stomach. The only appearance in the body was a gested state of the membranes of the brain. The most rapid case of th yet reported, was that of a soldier who was accidentally poisoned, in ptember 1846, in the Hospital of Val-de-Grâce. It appears that he allowed by mistake about an ounce of laudanum, and it is stated that he d in convulsions in *three quarters of an hour.* ('Journal de Médecine,' t. 1846, p. 475. For a similar case, see 'Med. Gaz.' vol. 45, p. 743.) It is possible that the drug may destroy life even with greater rapidity than this; but, as a medico-legal fact, we are at present entitled to state, that it has destroyed life within the short period above mentioned. On the other hand, the cases are sometimes much protracted. There are several instances of death in fifteen or seventeen hours. I have known one case fatal in twenty-two hours, and among those collected by Dr. Christison, the longest lasted twenty-four hours. (Op. cit. 712.)

POISONING BY POPPIES.

The heads of the white poppy grown in this country, possess narcotic properties. They yield an inspissated extract called English opium, which, according to Mr. Hennell, contains five per cent. of morphia. The white poppy-heads, therefore, yield to water, in the form of decoction, a poisonous substance capable of acting deleteriously on children. In July, 1863, a child died at Bilston, in consequence of its mother having administered to it two teaspoonfuls of water in which a poppy-head had been boiled. ('Med. Times and Gaz ,' July 18, 1863, p. 75.) Many cases of poisoning have occurred from the injudicious use of *Syrup of poppies*, which is nothing more than a sweetened decoction of the poppy-heads. This syrup is said to contain *one grain* of extract (opium) to one ounce (Thomson). The common dose of it, for an infant three or four months old, is half a drachm; for adults, two to four drachms. ('Pereira,' vol. 2, pt. 2, p. 643.) There is some reason to believe that what is often sold by many druggists under the name of syrup of poppies as a soothing or cordial medicine for children, is nothing more than a mixture of tincture or effusion of opium with simple syrup: it is therefore a preparation of variable strength. This may account for what appears to many persons inexplicable, namely, that an infant may be destroyed by a small dose. In January, 1841, a child six months old is said to have died from the effects of less than half a teaspoonful of syrup of poppies bought at a druggist's. The narcotic symptoms were fully developed in three quarters of an hour. The syrup in this case probably contained tincture of opium. Several children are reported to have lost their lives by this syrup in 1837-8. In one of these instances, a teaspoonful and a half was given. Stupor came on in half an hour, and the child died the following day. A teaspoonful has been known to prove fatal to a healthy child. ('Pereira,' vol. 2, pt. 2, p. 644.)

GODFREY'S CORDIAL.

This is chiefly a mixture of infusion of sassafras, treacle, and tincture of opium. The quantity of tincture of opium contained in it is stated by the late Dr. Paris to be one drachm in six ounces of the mixture, or *half a grain of opium to one ounce*: but it is probable that, like the so-called syrup of poppies, its strength is subject to variation. A case has been reported, in which half a teaspoonful, = 1-32nd part of a grain of opium, was alleged to have caused the death of an infant. In 1837-8, twelve children were reported to have been killed by this mixture alone. The explanation of this is, that the medicine usually is given in large doses by ignorant persons.

DALBY'S CARMINATIVE.

This is a compound of several essential oils and aromatic tinctures in peppermint water, with carbonate of magnesia and tincture of opium. According to the late Dr. Paris there are *five minims* of the tincture, or one quarter of a grain of opium, in rather more than two ounces of this mixture, or *the one-eighth of a grain in an ounce.* The formula commonly given is—carbonate of magnesia two scruples, oil of peppermint one minim, of nutmegs two minims, of aniseed three minims, tincture of opium five minims, spirit of pennyroyal and tincture of assafœtida of each fifteen minims, tincture of castor and compound tincture of cardamoms of each thirty minims, and of peppermint water two ounces. According to this formula, tincture of opium forms the 1-211th part by measure, or one teaspoonful contains the 1-64th part of a grain of opium. Like most of these quack preparations, it varies in strength. An infant is reported to have been destroyed by *forty drops* of this nostrum, a quantity, according to the strength assigned, equivalent to more than *two minims* of the tincture, or from one-sixth to one-tenth of a grain, of opium. Accidents frequently occur from its use, partly owing to ignorance, and partly to gross carelessness on the part of mothers and nurses.

The quack preparation, known under the name of *Locock's pulmonic wafers*, ontains opium. A boy, æt. 4, suffered from all the usual symptoms of poisoning by opium as a result of eating a quantity of these wafers or lozenges. Lancet,' Oct. 27, 1860, p. 420.)

Paregoric Elixir. (Camphorated Tincture of Opium.)

This is a medicinal preparation of alcohol, opium, benzoic acid, oil of anise nd camphor. Opium is the active ingredient, and of this the tincture ontains rather less than *one grain* in every *half ounce* (nine grains to five unces). In one case of poisoning by this tincture, a child aged seven months ied from the effects of a teaspoonful (equal to one quarter of a grain of opium) iven in two doses at an interval of a day. ('Pharmaceutical Journal,' April 845.) In another an infant of five weeks recovered from a similar dose, although no treatment was resorted to for nine hours. ('Med. Times and Gaz.,' ug. 6, 1859, p. 145.) An infant has been killed by a dose equivalent to not ore than the *ninetieth* part of a grain of opium (ante, p. 286).

Dover's Powder. (Powder of Ipecacuan and Opium.)

This is a preparation of opium, the effects of which on infants and children ave been already described (p. 286). The proportion of opium is one-tenth art or *one grain* in every *ten grains* of the powder. A child has been killed y four grains; therefore by a quantity containing about two-fifths of a grain f opium. Dr. Brown, of Lahore, relates the case of a child at fourteen onths, who took by mistake six grains of Dover's powder—equivalent to ix-tenths of a grain of opium—at six o'clock, P.M. In a quarter of an hour e felt drowsy and fell asleep; at two o'clock, A.M., eight hours after taking he poison, he had severe convulsions; his pupils were dilated, and his pulse as slow and irregular. He remained insensible, and died at three, A.M., nine ours after taking the powder. (On 'Poisons in the Punjab,' 1863, p. 71.) n the other hand, Mr. Ewens met with a case in which an infant of nine onths recovered from a dose of five grains. ('Med. Times and Gaz.,' May 9, 1860.) Dr. Guy has reported another, in which an infant of six months ecovered, under active treatment, from a dose of ten grains. ('Lancet,' une 8, 1850.) I am indebted for a still more remarkable instance of reovery to Mr. R. Read, of Dublin. Fifteen grains of Dover's powder were iven to an infant under five months of age. The mistake was discovered mmediately, and by active treatment the child recovered.

Black Drop.

This is a preparation of opium, in which the morphia is combined with cetic acid, and very little meconic acid is present. In the black drop, ccording to Pereira ('Mat. Med.' vol. 2, Pt. 2, p. 650), verjuice, the juice the wild crab, is employed as a solvent instead of vinegar. The black rop is considered to have from three to four times the strength of the tinc-ure of opium. The formula for this preparation will be found in Dr. eligan's work, 'On Medicines,' &c., p. 235. According to this, it is a compound of half a pound of opium to three pints of the expressed juice of the wild crab. It resembles the *Acetum Opii*, and has more than twice the strength of laudanum.

Sedative Solution. (Battley's.)

This is an aqueous solution of opium holding a little spirit and less meconic acid than the common tincture. ('Pereira,' vol. 2, Pt. 2, p. 646.) It is considered to have three times the strength of tincture of opium; but there is so great a difference of opinion on this point, that Dr. Neligan represents it as being only of about the same strength as laudanum. ('Medicines,' &c., p. 236.) He states that it is composed of three ounces of extract of opium, six drachms of spirit, and as much distilled water as will make up two pints. It appears to be in some cases an energetic preparation. Mr. Streeter stated at the Westminster Medical Society, Dec. 1838, that he had known one drachm and a half of it prove fatal to a lunatic; and twenty minims of the solution destroyed the life of an old woman. A medical gentleman, lying dangerously ill from an attack of dysentery, took, by mistake, about seven drachms of Battley's solution. Within five minutes, salt and water, with mustard, were administered, and twenty-four grains of sulphate of zinc. Vomiting ensued; the emetic was repeated, and with the same effect; the fluid evacuated at the second vomiting having the usual smell of opium. Half a drachm of ipecacuanha was subsequently given to complete the emptying of the stomach. Notwithstanding repeated vomiting, symptoms of narcotism presented themselves speedily, with contraction of the pupils, and great drowsiness—rendering it necessary to remove the patient from bed in his debilitated state, and keep him constantly moving, until about nine, P.M. (seventeen hours), when vomiting came on spontaneously, and he was put to bed and allowed to sleep. The original disease afterwards resumed its course (complicated by an attack of gastritis), and at length terminated favourably; but the patient had no recollection of what had occurred for twenty-four hours after the administration of the emetics; and it appeared to his medical attendants that an excited state of mind remained for some days afterwards. ('Prov. Journ.' Jan. 28, 1846, p. 42.) The death of Dr. Badeley, of Chelmsford, from a dose of this solution taken medicinally, furnishes an additional proof of the dangerous uncertainty in the strength of this solution.

Chlorodyne.

This is a compound of opium, chloroform, and prussic acid; it is flavoured with sugar and some essential oils. On standing, it separates into two liquids; one which floats, and is of a pale straw colour; another containing chloroform, which is heavy and of a brown colour and syrupy consistency. A fluid drachm yielded by evaporation twenty-seven grains of a brown saccharine extract. Prussic acid may be detected in it by the vapour test (nitrate of silver), and meconic acid, morphia and chloroform by their appropriate tests. Unless cautiously employed, it may give rise to accidents.

Nepenthe.

In a case recently tried at the Chester Assizes, the nature of the compound sold under the above name was a subject of enquiry. It is a pale sherry-coloured liquid, of a spirituous odour, with the smell of opium, and an acid reaction. It contains 3·4 per cent. of solid matter, consisting chiefly of a purified extract of opium with a small quantity of sugar. It may be regarded as a purified alcoholic solution of meconate of morphia, with a little excess of acid, and of about the same strength as laudanum. It has a similar mode of action.

MORPHIA AND ITS SALTS.

Morphia is the poisonous alkaloid of opium, of which it forms from five to ten per cent. The two principal salts of this alkaloid are the HYDROCHLORATE and the ACETATE.

Symptoms.—The symptoms generally *commence* in from *five* to *twenty minutes* after the dose of poison (if in solution) has been swallowed; and they closely resemble those observed in poisoning by opium. As a summary, it may be stated that they consist in dimness of sight, weakness and relaxation of the muscular system, tendency to sleep, stupor, loss of consciousness, coma, stertorous respiration, and more commonly than in poisoning by opium, there are convulsions. According to Orfila, in nineteen-twentieths of all cases the pupils will be found strongly contracted, a statement which I believe to be correct: the few exceptional cases were those in which the dose was excessive, and the symptoms were unusually violent. The state of the pupils gave rise to a great difference of opinion among the medical witnesses on the trial of Dr. Castaing. ('ON POISONS;' 2nd ed. page 619.) The condition of the pulse varies greatly. In some cases there is great irritability, as well as itching of the skin, and irritability of the bladder with difficulty of passing urine. Vomiting and purging have been met with in those instances in which the dose was large.

Fatal Dose.—Four cases are recorded in which a dose of *one grain* of hydrochlorate of morphia has proved fatal to adults: in one it was taken in solution; in a second in a pill; in a third in a powder; and in a fourth it was administered by injection into the tissue under the skin of the forearm. The first of the cases occurred to Dr. Paterson in Dec. 1845. ('Ed. Monthly Journal,' Sept. 1845, p. 195.) The morphia was taken in divided doses, in six hours. The symptoms and appearances were of the usual character, and insensibility came on rapidly. The patient died in about seven hours. The second case occurred at St. Mary's Hospital, May 1861: a man æt. 45 died in thirteen hours from a dose of one grain of hydrochlorate of morphia, prescribed in a pill by one of the physicians. The symptoms came on in about three hours, and were of a well-marked character. No morphia was detected in the stomach or other organs, and its operation as a poison was ascribed, without any apparent ground, to disease of the kidneys. In the third case (March 1863), I was consulted by Mr. Charsley, Coroner for Bucks. A healthy man, æt. 52, died in about ten hours from the effects of one grain. Three hours after taking the powder, he lost his senses of smelling and hearing, and passed rapidly into a comatose condition, from which he did not recover (case of *Cordery*, Burnham, March 1863.) The practitioner who prescribed the morphia alleged that he had given only half a grain, but the facts of the case were adverse to this statement. On analysis I could detect no morphia in the stomach. The fourth case occurred at the Middlesex Hospital, in May 1863. I am indebted for the particulars to Mr. De Morgan, under whose care the patient was placed. One third of a grain of morphia was injected at night under the skin: in two hours the injection of a similar quantity was repeated. On the next morning another third of a grain was injected. The man slept quietly for two hours. He then took some dinner, and talked in his usual way; but in another hour he became almost suddenly insensible, and in two hours he died, the narcotic ymptoms being most powerfully developed. Dr. Anstey met with a case in which three grains of morphia given as an injection per rectum caused death in sixteen hours.

The hydrochlorate is thus proved to be a powerful poison in a small dose: it may operate either suddenly or slowly and destroy life rapidly. An infant has died from a dose of one twelfth part of a grain. ('Chem. News,' Aug. 22, 1863,

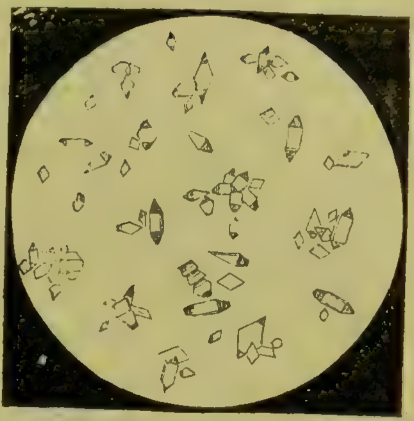
p. 98.) Dr. Christison considers that one grain of the hydrochlorate is fully equal in power to six grains of the best Turkey opium.

There is no reason to suppose that the acetate is less potent: but there are some remarkable instances of recovery where such a result could scarcely have been anticipated. In the 'Lancet,' for 1863, vol. 1, p. 8, is reported the case of a child about two years of age, who recovered from a dose of one grain of the acetate.

Appearances.—The only appearance which can be referred to the action of morphia is fulness of the cerebral vessels, with occasionally serous effusion. This poison has no local irritant action, and it therefore leaves no marks of its operation in the stomach and bowels. An account of the appearances produced by an overdose of sulphate of morphia has been published by Orfila in a report of the case of *Dr. Ellenberger.* ('Ann. d'Hyg.' 1852, vol. 2, p. 359.) The case presents some curious features. The deceased imagined that he had discovered a certain antidote for morphia and its salts, and proposed, while Orfila was at Prague in October 1851, to swallow the poison and the antidote in his presence. Orfila consented to witness the experiment. A powder was produced, which was found to have a bitter taste, and to possess some of the chemical properties of morphia, evidently mixed, however, with some other substance. The doctor swallowed about twenty-three grains of this powder, and immediately afterwards, his so-called antidote, which was a fine white powder having a sweetish taste. He did not suffer from any symptoms of poisoning. Orfila, with a keen eye to the practical use of antidotes, inquired whether he had ever allowed a certain interval to pass before taking the remedy. Dr. Ellenberger said that the results were the same. Six months after this experiment, Dr. Ellenberger died from a dose of about ten grains of sulphate of morphia. He had taken his antidote, but not until a considerable interval had elapsed. A minute inspection of the body was made, and the principal appearance was a well-marked congestion of the brain and its membranes. There were traces of sulphate of morphia in the stomach. The so-called antidote was examined, and found to consist of a mixture of magnesia and carbonate of magnesia!

Chemical Analysis. Opium.—There are no means of detecting opium itself, either in its solid or liquid state, except by its smell and other physical properties, or by giving a portion of the suspected substance to animals, and observing whether any narcotic effects are produced. The smell is said to be peculiar, but a similar smell is possessed by lactucarium, which contains neither meconic acid nor morphia. The *odour* is a good concomitant test of the presence of the drug, whether it be in a free state, or dissolved in alcohol or water, but it is not perceptible when the solution is much diluted. I found that half a grain of powdered opium, dissolved in half an ounce of water, lost its characteristic smell by a short exposure. The odour is decidedly volatile, and passes off when an opiate liquid is heated; it also escapes slowly at common temperatures. Again, it may be easily concealed by other odours, or the drug may undergo some change in the stomach during life which may rapidly destroy the odour. (Case by Mr. Barwis, p. 287.) The analysis in cases of poisoning by opium, is therefore limited to the detection of morphia and the acid with which it is combined, meconic acid.

Morphia.—Morphia may be identified by the following properties:—1. It crystallizes in fine prisms, which are white and perfect, according to their degree of purity. These crystals may be obtained by adding weak ammonia to a solution of morphia in hydrochloric acid. (See *illustration.*) 2. When heated on platinum, the crystals melt, become dark-coloured, and burn like a resin with a yellow smoky flame, leaving a carbonaceous residue. If this experiment is performed in a small reduction-tube, it will be found, by employing test-paper, that ammonia is one of the products of decomposition. 3. It is scarcely soluble in cold water, as it requires 1000 parts to dissolve it: it is soluble in one hundred parts of boiling water, and the hot solution has a faint alkaline reaction. By its insolubility in water, it is readily known from its salts. It is not very soluble in ether, thus differing from narcotina; but it is dissolved by forty parts of cold, and rather less than this quantity of boiling alcohol. It is dissolved by a solution of potash or soda, from which it cannot be removed by ether. It is very soluble in acetic ether, and this has been employed as a substitute for ether in procuring morphia from organic liquids. 4. It is easily dissolved by a very small quantity of all diluted acids, mineral and vegetable. 5. Morphia and its solutions have a bitter taste. 6. The salts of morphia are not precipitated in a crystalline form by solutions of sulphocyanide of potassium, ferrocyanide of potassium, or chromate of potash. In this respect they are strikingly distinguished from the salts of strychnia, which give well-marked crystalline precipitates with these three reagents.


Crystals of Morphia obtained by adding ammonia to a solution of the hydrochlorate, magnified 124 diameters.

Tests.—In order to apply the chemical tests for morphia, the alkaloid may be dissolved in a few drops of a diluted acid, either the acetic or the hydrochloric. If the hydrochlorate or the acetate of morphia is presented for analysis, the salt may be at once dissolved in a small quantity of boiling water. The tests for this alkaloid are the following: 1. *Nitric acid.* This, when added to a moderately strong solution of a salt of morphia, produces slowly a deep orange-red colour. If added to the crystals of morphia or its salts, deutoxide of nitrogen is evolved:—the morphia is entirely dissolved, and the solution acquires instantly the deep red colour above described,—becoming, however, lighter by standing. In order that this effect should follow, the solution of morphia must not be too much diluted, and the acid must be strong and added in pretty large quantity. The colour is rendered much lighter by boiling; therefore the test should never be added to a hot solution. 2. *Perchloride of iron* (sesquichloride), or colourless persulphate. Either of these solutions, when saturated and neutralized (by a small quantity of potash, if necessary), produces an inky-blue colour in a solution of morphia. If the quantity of morphia is small, or the test has a deep red or yellow tint, the colour is greenish. The blue colour is entirely destroyed by acids, and is also detroyed by heat: thus the iron-test should never be employed with a very cid or a very hot solution of a salt of morphia. It may be observed, that he blue given by the test in a solution of morphia, is entirely destroyed by itric acid and replaced by an orange-red colour, so that the nitric acid will et through the iron-test, but not *vice versâ*. In this way two tests may be pplied to one quantity of liquid. 3. *Iodic acid.* Morphia in the solid state r in solution, decomposes this acid, taking part of its oxygen, and setting free odine. In order to make this evident, the iodic acid should be first mixed ith starch; and a part of this mixture only, added to the suspected solution, -part being reserved, to allow of a comparison. (If the iodic acid be added a solution of morphia without starch, the liquid becomes brown, and smells iodine.) When the quantity is very small, there is only a reddish or purple nt slowly produced:—when large, the dark-blue iodide of farina is formed a few seconds. The colour being destroyed by heat, the test must not be dded to a hot solution. The test succeeds equally well with morphia or its alts, when unmixed with organic matter; but the analyst must remember, that the blue iodide of farina forms a colourless combination with a large quantity of starch: hence but little of this substance should be used, if the quantity of morphia is small. 4. *Sulphuric acid* and *bichromate of potash.* When strong sulphuric acid is poured on pure morphia in a solid state, there is either no effect, or the alkaloid acquires a light pinkish colour. On adding to this a drop of solution of bichromate of potash, or a small fragment of a crystal, it immediately becomes green (from oxide of chromium), and retains this colour for some time. Other alkaloids (strychnia) are not thus affected. Narcotina is turned of a bright yellow by sulphuric acid; therefore, although it becomes green when mixed with bichromate of potash, it could not be mistaken for morphia: besides, the green rapidly passes to a dingy brown colour. It may sometimes be desirable to determine whether morphia or any vegetable alkaloid is present in a suspected solution. For this purpose we may employ a solution of corrosive sublimate and iodide of potassium—the chloriodide of potassium and mercury (iodo-hydrargyrate of potash). If even a small quantity of morphia or any alkaloid is present, a whitish precipitate is thrown down on adding the test: this precipitate is an insoluble hydriodate of the alkaloid with iodide of mercury. This test is more sensitive with some alkaloids than others. A negative result proves the absence of morphia, provided the solution does not contain a large excess of alcohol or acetic acid, in either of which liquids the alkaloidal precipitate is soluble. It is not affected by ammonia, but gives yellow peroxide of mercury with potash or soda. It may be employed in the analysis of most of the poisonous principles and alkaloids, some of which may by means of it be readily distinguished from others. It is made by dissolving sixteen grains of corrosive sublimate and sixty grains of iodide of potassium in four ounces of water. As it gives a precipitate with albumen, this, when present, should be first removed by boiling the liquid to be tested.

Meconic Acid.—This is a solid crystalline acid, seen commonly in scaly crystals of a reddish colour. It is combined with morphia in opium, of which, according to Mulder, it forms on an average six per cent.; and it serves to render this alkaloid soluble in water and other menstrua. *Tests.*—Many tests have been proposed for meconic acid; there is only one upon which any reliance can be placed, namely, the *perchloride* or *persulphate of iron.* This test produces, even in a diluted solution of meconic acid, a deep red colour; and it is owing to the presence of this acid that a salt of iron strikes a red colour in tincture and infusion of opium, as well as in all liquids containing traces of meconate of morphia, the effects of the iron-test with morphia being counteracted by the presence of meconic acid. The red colour of the meconate of iron is not easily destroyed by diluted mineral acids, by a solution of corrosive sublimate, or by chloride of gold, but it is by sulphurous acid and chloride of tin. In liquids containing tannic acid, *e. g.* tea or beer, the action of this test is obscured.

Detection of Opium in Organic Mixtures.—Opium itself may be regarded as an organic solid, containing the poisonous salt which we wish to extract. It is not often that, in fatal cases of poisoning by opium or its tincture, even when these are taken in large quantity and death is speedy, we can succeed in detecting meconate of morphia in the stomach. It is probably removed by vomiting or absorption. If the matter is solid, it should be cut into small slices; if liquid, evaporated to an extract; and, in either case, digested with a large quantity of rectified spirit slightly acidulated with acetic acid. The residue should be well pressed in linen; the alcoholic liquid should then be evaporated in a water-bath until it is almost dry. The residue should be digested in water filtered and treated with acetate of lead, until there is no further precipitation. This liquid should be boiled and filtered: meconate of lead is left on the filter, while any morphia passes through under the form of acetate. The surplus acetate of lead contained in the filtered liquid (containing the morphia) should now be precipitated by a current of sulphuretted hydrogen—the sulphide of lead separated by filtration, and the liquid evaporated at a very gentle heat to an extract, so that any sulphuretted hydrogen may be entirely expelled. On treating this extract with alcohol, the acetate of morphia, if present in sufficient quantity, may be dissolved out and tested. If the alcoholic liquid is still much coloured, it may be again evaporated and taken up by water. Animal charcoal deprives it of colour, but at the same time removes the morphia if this is in small quantity. If there is a sufficient quantity of pure acetate present, the addition of a drop of solution of ammonia to a portion of the liquid on a slide, will produce crystals of the form of slender prisms which are somewhat deliquescent. The remainder may be tested by the nitric and iodic acids.

The *meconate* of lead left on the filter is readily decomposed by boiling it with a small quantity of diluted sulphuric acid; and in the filtered liquid, neutralized if necessary by an alkali, the meconic acid is easily detected by the iron-test.

This analysis requires care as well as some practice in the operator, in order that the morphia should be obtained in a sufficiently pure state for the application of the tests. Before resorting to this process, it is advisable to employ *trial tests* on the original liquid, in order to determine whether any meconic acid or morphia is present or not. The smell of opium may be entirely absent. The best trial tests are nitric acid and the permuriate of iron. These will produce in the infusion or liquid, if it contain opium, the changes already indicated. In testing for meconic acid, it is advisable to dilute the organic liquid, if coloured, with a sufficient quantity of water to render the production of a change of colour by the test perceptible. In respect to this method of detecting the meconate of morphia in a suspected liquid, it is proper to observe, that nitric acid will indicate the presence of morphia, and perchloride of iron the presence of meconic acid, in infusions containing so small a quantity of opium as not to be precipitated by the acetate of lead. The chief difficulty in the detection of morphia is that the alkaloid does not form more than one-tenth part of opium, and the quantity of opium present in an organic liquid is generally very small.

In consequence of the comparative insolubility of morphia in ether, Stas's process is not adapted for its separation from organic liquids. It has been lately suggested to employ acetic ether, as morphia is much more soluble in this liquid.

CHAPTER 25.

RUSSIC ACID—SYMPTOMS AND APPEARANCES—FATAL DOSE—TESTS FOR THE ACID —PROCESS FOR ORGANIC MIXTURES. CYANIDE OF POTASSIUM. ESSENTIAL OIL OF BITTER ALMONDS.

HYDROCYANIC OR PRUSSIC ACID.

ymptoms.—This acid has a hot bitter taste and an odour resembling that f bitter almonds diluted. The time at which the symptoms of poisoning ommence in the human subject, is liable to great variation from circumtances not well understood. When a large dose has been taken, as from alf an ounce to an ounce of the diluted acid, the symptoms usually comence in the act of swallowing, or within a few seconds. It is rare that heir appearance is delayed beyond *one or two minutes.* When the patient as been seen at this period, he has been perfectly insensible, the eyes fixed nd glistening, the pupils dilated and unaffected by light, the limbs flaccid, e skin cold and covered with a clammy perspiration; there is convulsive respiration at long intervals, and the patient appears dead in the intermediate period; the pulse is imperceptible, and involuntary evacuations are occasionally passed. The respiration is slow, deep, gasping, and sometimes heaving, or sobbing. The following case communicated to me by Mr. French, presents a fair example of the immediate effects of this poison in a large and fatal dose. A medical man swallowed seven drachms of the common prussic acid. He survived about four or five minutes, but was quite insensible when discovered, *i.e.* about two minutes after he had taken the poison. He was found lying on the floor senseless,—there were no convulsions of the limbs or trunk, but a faint flickering motion was observed about the muscles of the lips. The process of respiration appeared to cease entirely for some seconds: it was then performed in convulsive fits, and the act of expiration was remarkably deep, and lasted for a very long time. When the dose is large, the breath commonly exhales a strong odour of the acid, and this is also perceptible in the room. Convulsions of the limbs and trunk, with spasmodic closure of the jaws, are usually met with among the symptoms; the finger-nails have been found of a livid colour, and the hands firmly clenched. The breathing is generally convulsive, but when the coma or insensibility is profound, it is sometimes stertorous. This was noticed in a case which occurred to Dr. Christison. ('Edinburgh Monthly Journal,' February, 1850, p. 97.) It was also observed in the case of *Marcooley* (*Reg.* v. *Boroughs*, C.C.C., February, 1857). Stertorous breathing has not been hitherto recorded by toxicologists as one of the symptoms of poisoning by prussic acid. In the inquiry which took place at Rugeley, in January, 1856, respecting the death of *Walter Palmer*, it was contended that the fact of the deceased having had stertorous breathing was a proof that he had died from apoplexy, and not, as it was alleged, from prussic acid; but the facts here recorded show that such an inference is erroneous.

When a small dose (*i.e.* about thirty minims of a weak acid) has been taken, the individual has first experienced weight and pain in the head, with confusion of intellect, giddiness, nausea, a quick pulse, and loss of muscular power; these symptoms are, however, sometimes slow in appearing. Vomiting has been occasionally observed, but it is more common to find foaming at the mouth, with suffusion or a bloated appearance of the face, and prominence of the eyes. If death results, this is preceded by tetanic spasms, opisthotonos, and involuntary evacuations. Vomiting is sometimes the precursor of recovery. (See cases in 'Medical Gazette,' vol. 36, p. 103; vol. 35, pp. 859, 893.) A case which occurred to Mr. Bishop ('Prov. Med. and Surg. Jour.,' Aug. 13, 1845, p. 517) was remarkable in several particulars: the individual swallowed, it was supposed, forty minims of an acid (at three and a quarter per cent.), and was able to give an account of his symptoms. He was conscious for some time after he had taken it, and he recollected experiencing the sensation of his jaws becoming gradually stiff and tight, One of the most marked effects of prussic acid is to produce insensibility and loss of muscular power, much more speedily than any other poison. In some instances, there may be loss of consciousness in a *few seconds*; in others, certain acts indicative of volition and locomotion may be performed, although requiring for their performance several *minutes*.

Appearances.—The body when seen soon after death often exhales the odour of prussic acid; but if it has remained exposed before it is seen, and if it has been exposed to the open air or in a shower of rain, the odour may not be perceptible; again the odour may be concealed by tobacco-smoke, peppermint, or other powerful odours. In a case in which a person poisoned himself with two ounces of the acid, and his body was examined twenty-eight hours after death, the vapour of prussic acid which escaped on opening the stomach, was so powerful that the inspectors were seized with dizziness. In cases of suicide or accident, the vessel out of which the poison has been taken will commonly be found near; but there is nothing to preclude the possibility f a person throwing it from him in the last act of life, or even concealing it, f the symptoms should be delayed. (See case by Dr. Christison, page 298.) Owing to the great volatility of the poison, the vessel, if left uncorked, may not retain the odour when found. Putrefaction is said to be accelerated in hese cases; but from what I have been able to collect, there seems to be no round for this opinion (p. 57; also case in 'Prov. Med. Journ.' July 30, 1845).

Externally, the skin is commonly livid, or is tinged of a violet colour; the nails are blue, the fingers clenched, and the toes contracted; the jaws firmly losed, with foam or froth about the mouth, the face often pallid, but some-imes bloated and swollen, and the eyes have been observed to be wide open, ixed, glassy, very prominent and glistening, and the pupils dilated; but imilar condition of the eyes has been observed in other kinds of violent death. *nternally*, the venous system is gorged with dark-coloured liquid blood; he stomach and intestines may be in their natural state; but in several nstances they have been found more or less congested. The mucous mem-rane of the stomach of a dog which died in a few minutes from a dose of hree drachms of Scheele's acid, was intensely reddened throughout, pre-enting the appearance met with in cases of arsenical poisoning. In a large umber of experiments upon dogs, Mr. Nunneley states that he found enerally a congested condition of the mucous membrane of the stomach: if mpty at the time the poison was taken, the organ was found much contracted, nd of a brick-red colour. This appearance of congestion was observed on he mucous membrane of the vagina, the rectum, and conjunctiva, when the cid was applied to these parts. ('Prov. Trans.' N.S. vol. 3, p. 79.) Redness f the stomach was noticed in the case of the Parisian epileptics. ('Annales 'Hygiène,' 1829, vol. 1, p. 507.) Dr. Geoghegan, of Dublin, communicated o me the particulars of a case in which this redness of the mucous mem-rane was well marked. In April 1847, a healthy man, æt. 30, swallowed large dose of prussic acid. He was soon afterwards found dead in his bed. he body was inspected in five hours: rigidity had then commenced, and here was some warmth. The face was pale, the eyes were half closed, not resenting any remarkable brilliancy or prominence, and there was great ilatation of the pupils. The mouth was closed, and no froth issued from it. he abdomen was the only cavity examined. The muscles were red, and ave out, on section, a good deal of fluid blood, which had a strong odour of russic acid; the odour of the poison was also perceptible in the abdomen. bout eight ounces of a thick farinaceous mass were found in the stomach: he odour of prussic acid was very perceptible in this organ, but it was mixed ith that of rancid food. The mucous membrane had everywhere, except at he greater end and posterior wall, a vivid inflammatory redness, of a well-arked character, and it was covered with a layer of viscid mucus to a con-derable extent. The mucous membrane, even when washed three times in ater, gave out a strong odour of prussic acid. In a case which I examined May 1850, in which death had been caused by a large dose of the acid, ere was a generally congested state of the mucous membrane of the stomach. am indebted to Mr. Blaker, of Lewes, for an account of the appearances und in the body of a medical student who destroyed himself, in March 860, by swallowing about one drachm of Scheele's acid. He was found in a ate of collapse, and breathing heavily in about half a minute from the time which he was last seen. He died in twenty minutes. The coats of the omach were greatly congested towards the cardiac end. The minute vessels roughout were filled with dark blood, and there were some spots of effused blood beneath the mucous coat. The intestines were highly congested, the small vessels being visible all over the coats. There was no congestion of the membranes of the brain.

Quantity required to destroy Life.—The *smallest* dose of this acid which is reported to have caused death, was in a case which occurred to Mr. Hicks. ('Med. Gaz.' vol. 35, p. 896.) The female, a healthy adult, died in twenty minutes from a dose equivalent to *nine-tenths* of a grain of anhydrous prussic acid. This was equivalent to about *twenty grains* of Scheele's acid. In a case reported by Mr. T. Taylor ('Med. Gaz.' vol. 36, p. 104), a stout healthy man swallowed this dose, *i.e.* nine-tenths of a grain, by mistake, and remained insensible for *four hours*, when he vomited and began to recover. The vomited matters had *no odour* of the poison, showing that, if not concealed by other odours, the whole of the acid must have been absorbed. He had a very narrow escape of his life. Dr. Banks has published a case in which a female recovered after swallowing thirty drops of prussic acid. ('Ed. Med. and Surg. Jour.' vol. 48, p. 44.) The *largest* dose from which an adult has recovered, was probably in a case which has been reported by Mr. Burman. ('Lancet,' Jan. 14, 1854.) His father, æt. 60, of a strong constitution, took by mistake a *drachm* of prussic acid, equivalent to 2·4 grains of anhydrous acid. In a few seconds he perceived the mistake, and swallowed half an ounce of aromatic spirits of ammonia with a little water. Four minutes after taking the poison, cold affusion was employed, and sulphate of iron and spirits of ammonia were administered. Vomiting with convulsive shuddering and insensibility took place. In twenty minutes, consciousness returned, and fifteen minutes later, he was able to walk up-stairs to bed. He perfectly recovered, but in the absence of the early treatment resorted to, it is most probable that he would have died. Dr. Christison has reported in the 'Edinburgh Monthly Journal' (Feb. 1850, p. 97) the case of an adult who recovered after having taking a dose equivalent to a *grain and a half* or two grains of anhydrous acid. The treatment consisted in the evacuation of the stomach by the stomach-pump, and in pouring a current of cold water on the head. The symptoms were such that the man would have died, but for immediate treatment. It is a remarkable fact that in this case no bottle or vessel could be found in the room or under the window. The patient hastily summoned his wife one evening, told her that he had taken prussic acid, and immediately fell down senseless on a sofa, without either cry or convulsion, but drawing his breath deeply, forcibly, and slowly. He recovered in about three hours, but had an unusual disposition to sleep even on the following day. Another remarkable case of recovery from a dose nearly as large occurred to Mr. Bishop. ('Prov. Med. Jour.' Aug. 13, 1845, p. 517.) From the facts hitherto observed, we shall not be wrong in assuming that a quantity of Scheele's acid (at five per cent.) *above twenty grains* (i. e. *one grain of anhydrous acid*), or an equivalent portion of any other acid, would commonly suffice to destroy the life of an adult. This I believe to be the nearest approach that we can make to the *smallest fatal dose.* In *Reg.* v. *Bull*, tried at Lewes Autumn Assizes, 1860, a question arose respecting the minimum fatal dose of this poison. The accused, a young medical man, was charged with the manslaughter of his mother, a woman æt. 66. He had prescribed prussic acid for her to relieve sickness. He procured a bottle of Scheele's acid, said to contain one drachm. He administered four minims to deceased in the morning, and it appeared to benefit her. In the evening he gave to her another dose amounting, according to his statement, to 'seven drops.' The deceased went up-stairs, became insensible, and died in a few minutes. When the bottle was examined twenty-five minims remained in it: hence thirty-five minims were alleged to be missing, but the druggist who sold the acid poured out the quantity njecturally, and the bottle was found to have a broken cork. The strength the acid had not been determined. Under these circumstances the isoner was acquitted. In this case the Court desired to know the relation drops to minims; but no satisfactory answer could be given. The size of drop materially depends on the nature of the liquid, the mouth of the ttle, and the rapidity of the measurement. Seven drops of Scheele's acid opped from a small phial measured seven minims. There can be no doubt the above case that the poison caused death, and unless we assume that ven drops or minims will destroy life, which is not probable, the deceased ust have taken a much larger dose than the accused had intended.

Period at which Death takes place.—When the dose is two drachms and wards, we may probably take the average period for death at from *two* to *n* minutes. In Mr. Hicks's case, twenty grains of Scheele's acid destroyed e in twenty minutes. It is only when the dose is just in a fatal proportion, at we find a person to survive from half an hour to an hour. In this spect, death by prussic acid is like death by lightning, the person in general ther dies speedily or recovers altogether. According to Dr. Lonsdale, ath has occurred in the human subject as early as the *second*, and as late the *forty-fifth* minute. But although death does not commonly ensue til after the lapse of a few minutes, insensibility, and consequently a want power to perform acts of volition and locomotion, may come on sometimes a few seconds. The time at which this loss of muscular power is supposed take place, has frequently become an important medico-legal question; d on the answer to it the hypothesis of suicide or murder in a particular se may rest.

Chemical Analysis.—Prussic acid is limpid like water; it possesses a faint id reaction, and its vapour has a peculiar odour, which when the acid is ncentrated, although not at first perceptible, is sufficient to produce giddi- ss, insensibility, and other alarming symptoms. The tests which are best apted for the detection of this poison, either in liquid or vapour, are equally plicable whether the acid is concentrated or diluted, and, so far as the tection of the *vapour* is concerned, whether the acid is pure or mixed. *In e simple state*, the tests are three in number: the *Silver*, the *Iron*, and the *lphur* tests.

1. *The Silver Test. Nitrate of Silver.*—This yields, with prussic acid, a nse white precipitate, speedily subsiding in heavy clots to the bottom of e vessel, and leaving the liquid almost clear. The precipitate is identified cyanide of silver by the following properties:—*a.* It is insoluble in cold tric acid; but when drained of water, and a sufficient quantity of strong id is added, it is easily dissolved on boiling. *b.* It evolves prussic acid hen digested in hydrochloric acid. *c.* The precipitate, when *well dried*, and ated in a small reduction tube, yields cyanogen, hich may be burnt as it issues, producing a se-red flame with a blue halo. This is a well- arked character, and at once identifies the id which yielded the precipitate as prussic id. By this property, the cyanide is emi- ntly distinguished from all the other salts of ver. In the employment of the silver-test r the detection of the *vapour* of the poison, e place a few drops of the silver solution in watch-glass, and invert it over another watch- ass or beaker containing the suspected poi- nous liquid. Cyanide of silver, indicated by e formation of an opaque white film in the so- tion, is immediately produced, if only in a

Crystals of Cyanide of Silver from the vapour of prussic acid magnified 124 diameters.

moderate state of concentration. One drop of a diluted acid containing less than 1-50th of a grain of the anhydrous acid produces speedily a visible effect. When the prussic acid is more diluted, a few minutes are required; and the opaque film begins to show itself at the edges of the silver solution. In this case the action may be accelerated by the heat of the hand. If the vapour is allowed to reach the nitrate of silver gradually and much diluted with air, then instead of an opaque film of cyanide of silver, crystals well defined under the microscope will be slowly produced, and these will constitute an additional proof of the presence of the acid in a state of vapour. As shown in the illustration (p. 299), these crystals have the form of slender prisms with oblique terminations. They often hang together in groups, and generally require a high magnifying power to render them visible.

2. *The Iron-Test.*—The object of the application of this test, is the production of *Prussian Blue.* We add to a small quantity of the suspected poisonous liquid, a few drops of potash and of a solution of green sulphate of iron. A dirty green or brownish precipitate falls; on shaking this for a few minutes, and then adding diluted hydrochloric or sulphuric acid, the liquid becomes blue; and Prussian blue, of its well-known colour, unaffected by diluted acids, subsides. If the prussic acid is in small quantity, the liquid is at first yellow, from the salt of iron formed; it then becomes green, but the precipitate ultimately subsides so as to appear of a blue colour in the mass. The iron-test may be employed for the detection of the *vapour* of prussic acid, by the same method as that described in speaking of the silver-test. For this purpose we place a few drops of a solution of potash in a watch-glass or saucer, and invert it over the suspected liquid. After a few minutes' exposure a drop of solution of green sulphate of iron may be added, and then a drop of diluted hydrochloric acid, when Prussian blue will appear. The silver and the iron-tests may be easily conjoined in testing the same quantity of poison. If the precipitated cyanide of silver, obtained by the addition of nitrate of silver to the suspected liquid, is dried and then moistened with strong hydrochloric acid, the vapour may be collected in a watch-glass or saucer, on the plan above described. Prussian blue will be procured, and thus corroborate the action of the silver-test.

3. *The Sulphur-Test.*—Some years since Liebig proposed the following process for detecting prussic acid as a *liquid.* ('Oesterreichische Med. Wochenschrift,' März 27, 1847, p. 396.) If a small quantity of the bisulphide of ammonium is added to a few drops of a solution of prussic acid, and the mixture is gently warmed, it becomes colourless, and, on evaporation, leaves crystals of sulphocyanate of ammonia—the sulphocyanic acid being indicated by the intense blood-red colour produced on adding to the dry residue a solution of a nearly neutral persalt of iron: this red colour immediately disappears on adding a few drops of a solution of corrosive sublimate. The colour is also destroyed by strong acids, and its intensity is diminished by moderate dilution with water. This process is very delicate, and it therefore requires some care in its application: thus, if the boiling and evaporation are not carried far enough, the persalt of iron will be precipitated black by the undecomposed sulphide; and, if the heat be carried too far, the sulphocyanate of ammonia may itself undergo decomposition, and be lost. It will be perceived, too, that it requires a longer time for its application than either the silver or the iron-test. If the prussic acid contains traces of Prussian blue or a salt of iron, it will acquire a dark colour on the addition of the sulphide.

The great utility of the *sulphur-test*, however, is in its application to the detection of the minutest portion of prussic acid when in a state of *vapour.* In this respect it surpasses any other process yet discovered. In order to apply it, we place the diluted prussic acid in a watch-glass, and invert over another watch-glass, holding in its centre one drop of the bisulphide of nmonium. No change apparently takes place in the sulphide; but if the atch-glass is removed after the lapse of from half a minute to ten minutes, cording to the quantity and strength of the prussic acid present, crystallized lphocyanate of ammonia will be obtained on gently evaporating the liquid to yness. With an acid of from three to five per cent. the action is completed ten seconds. The addition of one drop of the neutral persulphate of iron ree from nitric acid), to the dried residue, brings out the blood-red colour in-antly, which is intense in proportion to the quantity of sulphocyanate present. ich is the simple method of employing the vapour test. When the prussic acid much diluted, the warmth of the hand may serve to expedite the evolution of e vapour. I have elsewhere made some remarks on the application of this ocess for the detection of prussic acid. (See 'Med. Gaz. 1847.' vol. 39, p. 765.)

Prussic Acid in Organic Liquids. Detection by Vapour without Distillation. -The organic liquid may be placed in a wide-mouthed bottle, to which a atch-glass has been previously fitted as a cover. The capacity of the bottle ay be such as to allow the surface of the liquid to be within one or two ches of the concave surface of the watch-glass. The solution of *Nitrate of ver* is then used as a trial-test in the way already described. If the 1-200th a grain of prussic acid is present, and not too largely diluted, it will be de-cted (at a temperature of 60°) by the drop of nitrate of silver being converted to an opaque white or crystalline film of cyanide of silver, the chemical change mmencing at the margin. We may then substitute for the nitrate of silver e bisulphide of ammonium, and proceed in the manner above described. It ay be sometimes necessary to place the bottle in a basin of warm water. If e solution of silver is tarnished by sulphuretted hydrogen, as a result of putre-ction, the sulphur-test alone should be used. By this process I have detected ussic acid in the stomach of a person poisoned by it, as late as twelve days er death. After the stomach had been exposed for a few days longer, all aces of the poison had disappeared.

Detection by Distillation.—This process was originally suggested by Las-gne. The organic liquid should be distilled in a water-bath, at 212°, and out one-sixth or one-eighth of the contents of the retort, collected in a re-ver kept cool by water. The tests may now be applied to the distilled uid. If the trial-tests indicate that the quantity of poison is small, a solu-n of nitrate of silver or caustic potash may be placed in the receiver, to fix the d as it is distilled over; Prussian blue may then be procured in the manner scribed, or the vapour may be at once absorbed by bisulphide of ammonium the receiver, and the liquid evaporated to obtain sulphocyanate. Prussic d has been found in the stomach by *distillation*, so late as *seven* days after ath, although the odour could not be perceived before distillation. In the se of *Montgomery* (Report of trial of Thompson, Glasgow Circuit Court, 1857, Hugh Cowan, pp. 9 and 53), the deceased died in about fifty minutes after ving taken two drachms of prussic acid (equivalent to three and a quarter ins of anhydrous acid). The death took place on the 13th September: the dy was buried on the 17th, and exhumed on the 30th. The parts removed re then put into stoppered bottles, and on the 5th October the Drs. McKinlay ected prussic acid doubtfully by the odour, but distinctly by the three tests, the stomach, before distillation, as well as in the liquid distilled from the mach and its contents. They did not succeed in detecting its presence in tissues. About five weeks subsequently to this analysis, the viscera, which l been kept closely secured in glass bottles, were examined by Dr. Maclagan. e heart, kidneys, and intestines gave no indication of the presence of the son, but it was detected by the sulphur-test, in the form of vapour, in one lf of the spleen, although there was no odour of the poison. When the viscera containing the poison have undergone putrefaction, no trace of the acid may be found either by its vapour or by distillation. In this case it may have been converted into sulphocyanate of ammonia by the sulphide of ammonium produced during putrefaction. The sulphocyanate may be dissolved out of the dried viscera or liquids by alcohol, and the solution evaporated to dryness and tested by a persalt of iron. Much is lost by reason of the great volatility of the acid. I have found the vapour to traverse wet and dry bladder in a few minutes. Hence all viscera suspected to contain prussic acid should be preserved in well-stoppered bottles.

In the Tissues.—Soon after death the poison may be easily detected in the blood, secretions, or any of the soft organs, by placing them in a bottle, and collecting the vapour in the manner already described. This will be found to be far more convenient and satisfactory than the process by distillation. In the case of a dog poisoned by a large dose of prussic acid, Mr. Hicks brought to me the stomach after it had been exposed twenty-four hours, and thoroughly washed under a current of water, and yet the poison was readily detected by placing the whole organ in a bottle, and absorbing the vapour by nitrate of silver. This shows how completely the animal tissues at death are penetrated by prussic acid, and how firmly for a time it is retained by them. The poison has been thus discovered, in experiments on animals, in the blood and in the serous exhalation of the chest.

CYANIDE OF POTASSIUM.

Symptoms.—This salt has a bitter taste, producing first a sense of coldness on the tongue, followed by a feeling of constriction, and burning heat, in the throat. It is one of the most formidable poisons known to chemists. It has destroyed life in a quarter of an hour. A dose of five grains has proved fatal in three instances. In one case the person died in two hours. ('Chem. News,' Sept. 5, 1863.) The symptoms which the cyanide produces are similar to those occasioned by prussic acid:—insensibility, spasmodic respiration, convulsions, with tetanic stiffness of the jaws and body. They appear in a few seconds or minutes, and run through their course with great rapidity.

Insensibility is not always an immediate symptom. A woman, who at the time was under medical treatment, took by mistake a teaspoonful of a solution of cyanide of potassium, this quantity containing about seven grains of the salt. Immediately after taking it she complained of a severe burning pain in the stomach, and a feeling as if the bowels were about to act. She went to the water-closet, and her strength left her. She was removed to bed, and speedily became unconscious. It was found impossible to introduce anything into the stomach. She died in less than an hour. There was no convulsion before death, but a sudden convulsive action of the body took place after the heart had ceased to beat. The appearance of the body was so natural, even on the day following death, that some of her friends supposed there might still be life. ('Boston Medical and Surgical Journal,' Dec. 11, 1856, and 'Brit. and For. Med. Rev.,' 1857, vol. 19, p. 498.) In June 1856, a woman swallowed an ounce and a half of a solution of cyanide of potassium, used for photographic purposes. The quantity taken amounted to five grains. In two minutes she became unconscious, the whole of the body was slightly convulsed, and the pupils of the eyes were dilated. She foamed at the mouth, the pulse was small and feeble, and there was spasmodic closure of the jaws. Nevertheless, as she had lost some teeth, there was sufficient space for the introduction of the tube of the stomach-pump, within five minutes after she had taken the poison. She died in twenty minutes. In the Registrar General's Report for Oct. 3, 1857, three deaths are stated to have occurred from this salt, among the families of soldiers: two were cases of suicide and one of accident. It appears that they employ it for cleaning lace. (For other cases of its fatal action see 'Med. Times and Gaz.,' Oct. 12, 1850, p. 390; Nov. 9, 1850, p. 482; and July 12, 1851, p. 41; also, 'Chem. News,' April 27, 1861, p. 260.) The salt is much used by photographers, and has given rise to many accidents among persons engaged in the practice of this art.

Appearances.—In a case in which an inspection of the body was made two days after death, there was no remarkable odour:—the muscles were stiff and rigid; the face, and fore part of the trunk, pale; the back part livid, except those portions which had sustained pressure. The fingers and toes were convulsively bent inwards, the nails blue, eyelids half-closed, lips pale, the vessels of the brain filled with blueish-red (blaurothem) blood. On making a section of the brain and spinal marrow, bloody points were observed. The lungs were congested posteriorly, and on cutting into them, a strong odour of bitter almonds was perceived. A yellowish mucus was found in the stomach, which yielded on analysis cyanide of potassium. The mucous membrane was reddened near the intestinal end. The poison was not detected in any part of the body except the contents of the stomach and intestines. 'Casper's Wochenschrift,' Oct. 4, 1845, 657.) In Nov. 1851, a girl, æt. 18, was brought to Guy's Hospital. Half an hour before her admission, she was seen to swallow a solution of cyanide of potassium. She vomited once. It is stated that she was alive when put into the cab, but when taken out at the hospital seven minutes afterwards, she was completely insensible, pulseless at the wrist, and to all appearance dead. Artificial respiration was at once resorted to, ammonia was applied to the nostrils, warmth to the extremities, and cold affusion to the spine; but all to no effect, and with the exception of an alteration in the pupils observed during the first few minutes of her admission, she evinced no sign of vitality. The body was inspected on the following day. The stomach contained a large quantity of half-digested food: its mucous membrane was of a pink colour and deeply injected, especially in patches. Every other organ was healthy, and there was no appearance of corrosion about the mouth. The contents of the stomach were of a pale straw colour, semi-fluid, and had a decidedly bitter almond odour. Prussic acid was detected in them. See also a case by Dr. Ellis, 'Lancet,' Oct. 17, 1863, p. 447.

This poison is generally fatal. A rare instance of recovery was communicated to me by Mr. Taafe, of Brighton. In March, 1862, a man swallowed the greater part of a solution containing an ounce of the commercial cyanide, which he had dissolved for the purpose. Mr. Taafe found the man a few minutes afterwards lying in the street insensible, and breathing stertorously; and in about ten minutes he applied the stomach-pump with cold affusion freely. In two hours the man vomited, and from that time rapidly recovered.

Cyanide of potassium has a local chemical action upon the skin; and if this is abraded or wounded, it may be absorbed and produce serious effects. Some accidents of this kind have occurred in the practice of photography. ('Ann. d'Hyg.' 1863, vol. 1, p. 454.)

Analysis.—Cyanide of potassium is usually seen in hard white masses. It is deliquescent, and very soluble in water: the solution, when pure, is colourless, and has a strong alkaline reaction, a soapy feel, and a powerful odour of prussic acid. It is not very soluble in pure and strong alcohol. 1. It is decomposed by all acids, and prussic acid is set free. 2. The potash is precipitated by tartaric acid and chloride of platinum. 3. It gives a white precipitate with nitrate of silver, which, when dried and heated, possesses all the properties of cyanide of silver (ante, p. 299). This precipitate is easily redissolved by a slight excess of the solution of cyanide of potassium. 4. If a solution of proto-sulphate of iron is added to a solution of the cyanide of potassium, and after agitation diluted sulphuric acid, Prussian blue will result.

5. A single grain of this salt moistened with water in a watch-glass, gives a well-marked reaction, by its vapour, with the silver and sulphur tests. Should this experiment fail, a drop of the bisulphide of ammonium may be heated with the cyanide—the liquid acidulated with hydrochloric acid, and a solution of persulphate of iron added. The red colour of the sulphocyanate of iron is immediately brought out.

Organic Substances.—The salt may be obtained as a soluble fixed residue from organic matter by drying and incinerating it in close vessels; or prussic acid may be at once procured by distilling the contents of the stomach with diluted sulphuric acid.

Essential Oil of Bitter Almonds.

This liquid, which is used for the purpose of giving flavour and odour to confectionery, owes its poisonous properties chiefly to the presence of prussic acid. It contains a variable quantity of the poison, but this has been found in it in a proportion of twelve per cent. *Almond flavour* or essence of peach kernels contains one drachm of the essential oil to seven drachms of rectified spirits.

Symptoms.—The following may be taken as a summary: lividity of the face; eyes glassy, prominent, fixed and staring; pupils dilated and insensible to light; jaws spasmodically closed; frothy mucus about the mouth; in some cases, vomiting of food; coldness of the skin; heaving and intermittent respiration, sometimes stertorous; absence of the pulse; head spasmodically drawn backwards, and sometimes the trunk; general relaxation of the limbs; an odour of bitter almonds about the mouth.

In a case, the particulars of which were communicated to me by Dr. Bull of Hereford, a woman swallowed about seventeen drops of the essential oil, and she died in half an hour. She was seen by Dr. Bull in about fifteen minutes: her face was livid; the lips were separated; the teeth clenched; there was froth about the mouth; the eyes were half-shut and glassy; the pupils dilated and fixed; there were heavings of the chest at intervals; there was no pulse, and the action of the heart was scarcely perceptible. No odour was perceived about the body until after the stomach-pump had been used. The first symptoms observed in this case were strong convulsions, the deceased throwing her arms about as if in pain. A boy, æt. 13, swallowed a quantity of the oil; he was found lying on the floor motionless and insensible; his face pale; his eyes open and fixed, the pupils dilated, and he was rolling and panting for breath; the pulse at the wrist was imperceptible; he died in a quarter of an hour without any convulsions appearing. A man, æt. 20, swallowed about two ounces of the oil. A person present saw him fall suddenly while in the act of swallowing, he made a loud cry, gave one deep expiration, and died.

In another case, a woman, æt. 46, who had been in the habit of using the almond essence for flavouring confectionery, swallowed about half an ounce (thirty drops of the oil). She died in less than half an hour. When seen by a medical man ten minutes after she had taken the poison, she was perfectly insensible. The face was pale but swollen, and covered with perspiration; the eyes stared fixedly as if in terror; the pupils were dilated. The lips were partly closed and livid, and a frothy mucus issued from the mouth. The lower jaw was firmly contracted, while the muscles of the neck and of the limbs, excepting those of the fingers, were flaccid. She breathed slowly and heavily, making about ten respirations in a minute; the pulse was from 30 to 40, and feeble. There was an odour of bitter almonds in the breath. Some blood which was drawn from the arm was thick and dark, resembling choleraic blood. In spite of the use of the stomach pump and cold affusion, the patient did not show any signs of recovery, but gradually sank. ('Assoc. Med. Jour. Dec. 13, 1856, p. 1055.)

In March, 1853, a woman, æt. 39, swallowed half an ounce of *almond flavour*, containing half a drachm of the essential oil. In ten minutes she was seen by Mr. Phillips, who found her perfectly insensible and motionless; the pupils were moderately dilated and insensible to light; the mouth was partly open, the lips were pale, there was no distortion or spasmodic movement of the features; the pulse was slightly tremulous, and entirely ceased in a few minutes; the breathing was slightly stertorous, and took place at long intervals. She continued in this state for twenty minutes without any convulsive movements of the body, when she died, *i.e.* half an hour after she had taken the poison. In another case two drachms destroyed life in seventeen minutes. ('Lancet,' Oct. 17, 1863, p. 447.)

Appearances.—In Dr. Bull's case (*supra*), on inspection nine hours after death no odour of almonds was perceptible in the chest, head, or heart, nor in the venous blood with which the system was gorged. The lungs and heart were healthy. The vessels of the brain were congested, and there was a general effusion of serum on the hemispheres. The lining membrane of the stomach was much congested. On opening it the bitter-almond odour was quite perceptible. (See 'Prov. Med. Jour.' Sept. 11, 1844, p. 364.) In the case of the boy (*supra*), which proved fatal in a quarter of an hour, on inspection there was pallor of the face, with lividity of the depending parts; the lungs were congested; the odour of the poison was perceptible only in the abdomen, and very distinctly in the contents of the stomach. The mucous coat of this organ was generally pale, but there were some patches of ecchymosis scattered over it. The essential oil and prussic acid were detected in it. ('Lancet,' July 12, 1845, p. 40.) In a case which proved fatal in three hours, the skin was partially livid, the blood fluid, and the membranes of he brain as well as the lungs were gorged. The contents of the stomach had a strong smell of the oil, and the mucous coat towards the intestinal opening had a red appearance. The other organs were healthy. The blood, with which the venous system is gorged, is generally liquid and of a dark colour.

Analysis.—The *essential oil*, which is often called peach-nut oil, is colourless when pure, but it commonly has a pale yellow colour, and a strong odour of bitter almonds, by which it may be at once identified. It has a hot, burning taste, and a feebly acid reaction. It produces, when dropped on paper, a greasy stain which does not entirely disappear by the application of heat. It has a sp. gr. of 1·043; it sinks in water, which dissolves about one-thirtieth part. It is soluble in alcohol and ether in all proportions. When mixed with a few drops of strong sulphuric acid, it forms a rich crimson-red liquid which, if exposed to air, acquires a yellow colour. When poured into cold water, the crimson liquid is immediately destroyed, and a yellow colouring matter falls in globules. The smell and taste of this oil are sufficient for its identification; but nitrobenzole possesses the same odour, and has been mistaken for it.

The vapour of prussic acid does not so readily escape from this oil as from he watery solution: hence the vapour-tests do not give the same characteristic results. *Tests.* 1. Add to one or two drops of the oil a like quantity f bisulphide of ammonium. Mere mixture at a low temperature only produces sulphocyanate after standing ten minutes or longer: but if the liquid is warmed to 100°, the conversion is immediate, and the change is indicated by he blood-red colour struck on adding to the liquid persulphate of iron. If any unchanged sulphide should give a black colour, this may be removed by the addition of one or two drops of hydrochloric acid. 2. Dissolve one or two drops of the oil in alcohol and add to the mixture a few drops of a solution of potash, followed by a solution of green sulphate of iron and hydrochloric acid. Prussian blue is formed on agitating the mixture, but it does not appear until the precipitated oxide of iron is dissolved by the addition of diluted sulphuric or hydrochloric acid. The silver-test is inapplicable to the oil in its ordinary state. The vapour of the oil produces no change in a drop of a solution of nitrate of silver, except after long exposure. If, however, the oil be heated, there is an immediate production of cyanide of silver. The two tests above mentioned are sufficient for all practical purposes.

Bitter almond water, laurel water, and the essences of peach and cherry kernels, owe their noxious properties to the presence of prussic acid.

CHAPTER 26.

NARCOTIC LIQUIDS AND VAPOURS—SULPHIDE OF CARBON—COAL-NAPHTHA—WOOD-NAPHTHA—AMYLENE—FUSEL-OIL. AMYLIC ALCOHOL—BENZOLE—NITROBENZOLE—ANILINE—OIL OF WORMWOOD—NITROGLYCERINE OR GLONOINE.

Sulphide of Carbon.

This liquid is extensively used in the arts as a solvent for phosphorus, sulphur, and caoutchouc. Nothing is known of its effects on man as a liquid; and from its powerful and offensive odour it could not be readily administered with homicidal intention. The effects of its vapour have been chiefly observed among workers who employ this liquid. It produces headache, loss of appetite, impairment of vision and hearing, and causes general derangement of health, evidently by an operation on the nervous system. (See 'Chem. News,' May 2, 1863, p. 216.)

Analysis.—The odour of this liquid is sufficient to identify it even in the smallest quantity.

Coal Naphtha.

The light oily product of the distillation of coal, known under the name of naphtha, and chemically described as a hydrocarbon, has caused death in one case, under symptoms of narcotic poisoning. A boy, æt. 12, swallowed inadvertently about three ounces of naphtha, in the state in which it is used for lamps. He soon appeared as if intoxicated, and ran about in a wild delirium. When seen in a short time by a medical man, he was insensible—in a state of collapse—breathing stertorously, and his skin was cold and clammy. He had already vomited part of the liquid, and the odour of the vomited matter at once showed that he had taken coal naphtha. By the promotion of vomiting, he was made to eject altogether two tablespoonfuls of naphtha, and he partially recovered. In spite of this reaction, however, in about two hours he was again in a state of collapse, insensible, pulseless, gasping for breath, and frothing at the mouth. The eyes were fixed and glassy, and the pupils contracted. There was complete loss of muscular power, and great difficulty of breathing, but no convulsions. He had lost the power of swallowing. In spite of every effort to save him, he died in less than three hours after swallowing the liquid. On inspection of the body four days after death, a strong smell of naphtha was perceived throughout the tissues. The blood was fluid, there was slight effusion of serum in the ventricles of the brain. The right side of the heart contained fluid blood, the left was empty, the lungs were not congested, but pale. The coats of the stomach were not inflamed or materially changed in appearance. This organ contained a pint of semifluid matter, of which four or five ounces were liquid. An ounce of a dark-coloured liquid floated on the top, and was easily skimmed off. This was found to be naphtha by its lightness, its insolubility in water, and by its inflammability. It burnt with a thick smoky flame. The liquid appeared to act in this case as a pure narcotic. There were no onvulsions. The respiration of the *vapour* of this liquid diluted with air roduces headache, giddiness, severe pain in the stomach, loss of appetite and eneral illness. ('Lancet,' Aug. 23, 1856, p. 230.)

Analysis.—The peculiar odour as well as inflammability of the liquid, and e fact that it burns with a bright yellow smoky flame, would be sufficient identify coal-naphtha. Its lightness and insolubility in water would, as in e case above mentioned, allow of its being readily separated from the queous contents of the stomach.

Wood-Naphtha. Wood Spirit.

The term Naphtha is frequently applied to a product of the destructive stillation of wood, differing entirely in composition and properties from the ydrocarbon above described as coal-naphtha. It is also known under the mes of methyl alcohol and pyroligneous ether. It differs from coal-phtha, among other properties, in being miscible with and soluble in water, all proportions. It is a nauseous liquid in odour and taste. When mixed the proportion of one-tenth part with rectified spirit, it forms a compound w largely employed as a solvent in the arts and medicine under the name *Methylated spirit.* It has a hot disagreeable spirituous taste, and like ethylated spirit it would no doubt operate as a narcotic poison. Its odour so powerful and peculiar, that no one could swallow it unknowingly. I ve not met with an instance of the effects of this liquid on man; but I have en the effects produced by the respiration of its vapour on a large scale. causes headache, loss of appetite, nausea, sickness, languor, and a general eling of illness.

Analysis.—It is one of the most inflammable of liquids, burning with a le blue flame. It is light and volatile, readily separable from other liquids distillation below 200°. Its odour is peculiar. It mixes with water and ohol in all proportions. Alcohol containing one-tenth part of it is rendered nauseous that it cannot be used for the purposes of drinking.

Amylene.

The vapour of this liquid was introduced by the late Dr. Snow as a substi-e for the vapour of chloroform. It produces a loss of sensibility without sing complete coma or stupor. It use has already led to at least two ths; and it is not so safe an agent as chloroform vapour for surgical poses. The only *appearance* met with in one fatal case, was an emphyse-tous state of the lungs or excessive dilatation of the air-cells ('Med. nes and Gazette,' April 4 and 18, 1857, pp. 332, 381); and in the other, istension of the right cavities of the heart with dark fluid blood. There s no congestion of the brain, and no smell of amylene perceptible in the y. ('Med. Times and Gazette,' Aug. 8, 1857 p. 133.)

Fusel Oil. Amylic Alcohol.

his liquid is also known under the name of Potato-spirit or oil of grain. s of an alcoholic nature, but less volatile than alcohol and ether: hence it ommonly a product at the latter part of the distillation of spirit from nented potatoes and cereal grains, imparting a disagreeable odour and e to the brandies produced. Its vapour when respired in a diluted state rritating to the lungs; it produces headache, nausea, and a feeling of liness, with a sense of suffocation and inability to stand or walk.

r. Furst, of Berlin, found that two drachms of the liquid thrown into the nach of a rabbit, caused great restlessness and loss of muscular power; the animal soon recovered. A similar quantity killed another rabbit in ut two hours: the principal symptoms were great depression and difficulty of breathing. On inspection of the body, there was extravasation of dark brown blood at the gullet end of the stomach, and the mucous membrane presented brownish red points. The lining membrane of the duodenum and upper part of the small intestines, was reddened and filled with mucus, the kidneys were healthy and bloodless, and the lungs somewhat redder than natural. Three drachms killed a rabbit within an hour. Half an ounce caused death in a quarter of an hour, and one ounce in four minutes. Fusel oil, as a liquid, appears to have at first a stimulating and afterwards a depressing action. In small quantities it produces intoxication. (See ‘London Med. Gaz.’ vol. 35, p. 430.) This liquid is absorbed into the blood, and after a time, may be detected by its peculiar odour in the breath. Its toxicological effects are more potent in the state of vapour than when taken as a liquid into the stomach.

Analysis.—Fusel oil is a volatile liquid of a pale yellow colour, lighter than water and only sparingly soluble in it. It is dissolved by alcohol and ether in all proportions, but not readily by chloroform. Water separates it from its ethereal solution. It has a hot burning taste and an offensive spirituous odour, which is very persistent and peculiar: by this it may be distinguished from other alcoholic liquids. It is inflammable and burns with a pale blueish flame. Like alcohol, ether, and wood-spirit, it decomposes chromic acid, producing green oxide of chromium. In organic mixtures ether might be used for its separation. By distilling one part of fusel oil with two parts of acetate of potash and one part of oil of vitriol, an ethereal liquid is produced which is used in confectionery under the name of *Essence of Jargonelle Pear.* A child on two occasions became partially comatose and had livid lips and a feeble pulse, after eating some confectionery which it was calculated contained about one drop of this essence. Hence its use is not without danger. (See ‘Pharm. Jour.’ Nov. 1851, p. 214.)

BENZOLE.

This is a colourless volatile liquid, hydrocarbon obtained by the distillation and rectification of coal naphtha. The respiration of its vapour produces narcotic effects, but with some symptoms indicative of a noxious action on the brain and spinal marrow, *e.g.* noises in the head, convulsive trembling, twitchings of the muscles, convulsions, with difficulty of breathing. (See paper by Dr. Stone, ‘Medical Gazette,’ 1848, vol. 41, p. 1077.) But little is known concerning the action of liquid benzole on the human subject. It is poisonous to the lower animals and to all parasites; and it has been suggested by Dr. Sonnenkalb as a remedy for destroying the trichina spiralis (p. 278). This writer also refers to a case in which a quantity of liquid benzole was swallowed by a man, and it operated as a narcotic. (Anilin und Anilin-farben, Leipzig, 1864, p. 13.)

Analysis.—The odour and inflammability of the liquid, as well as its insolubility in water, are sufficient to identify it, and to allow of its separation from organic liquids.

NITROBENZOLE.

This liquid, which is now largely employed as a substitute for the essential oil of bitter almonds in perfumery and confectionery, has now taken its place among narcotic poisons. In the second edition of my work on Poisons (1859) some experiments were quoted from the ‘Lancet’ (Jan. 10, 1857, p. 46), showing that one drachm of nitrobenzole killed a rabbit almost instantaneously; and half a drachm mixed with two drachms of water rendered a cat insensible for several minutes, a slimy mucus flowing from its mouth for several hours afterwards. The animal refused all food, and died in twenty-four hours. (‘On

Poisons,' 1859, p. 701.) In 1859, the late Professor Casper, of Berlin, published an account of this liquid under the name of 'A new Poison' ('Viertel-jahrschrift,' B. 16, p. 1.) Its effects on a rabbit and a dog are here described. Two drachms of it were given to a rabbit without any symptoms being produced; two drachms were then given to the animal at intervals of ten minutes or a quarter of an hour until the rabbit had taken one ounce. In a minute and a half after the last dose, the animal fell suddenly on its left side. The pupils were dilated, while the limbs and tail were strongly convulsed. The animal died in a minute. The dose was probably unnecessarily large, but the result shows that nitrobenzole in a large dose destroys life rapidly. On opening the body, the powerful odour of the liquid was everywhere perceptible, even in the blood. This odour remained strongly in the body when it was again examined fourteen days after death. Twenty cubic centimeters (about five drachms) given to a middle-sized dog produced no remarkable symptoms. After some hours the animal was observed to be dull and languid: in twelve hours there was profound coma with slow respiration and coldness of the skin: but there were no convulsions. The animal was then killed. All the solids and liquids of the body, including the blood, had a strong odour of the poison; and some drops of the oily liquid were separated from the contents of the tomach. The fluid on which it floated had a strong alkaline reaction. The blood retained the odour for several days.

Passing from experiments on animals to the effects produced on man, the following cases are of interest: they tend to show that, as in the action of hloroform and fused oil, the vapour is much more potent than the liquid.

Mr. Nicholson ('Lancet,' Feb. 1, 1862, p. 135), in referring to one fatal ase of poisoning by the liquid, states that he has known several instances in which the *vapour*, as it is evolved from almond glycerine soap, has seriously ffected females. A friend of his who used a cake of the soap in taking a warm bath fainted from the effect of the vapour of nitrobenzole set free, and was ill for some time afterwards. In July, 1863, Mr. Fotherby communicated o me a case of poisoning by this compound, in which the symptoms so closely esembled those of the essential oil of bitter almonds, that it was at first sup- osed this oil had been taken. A woman, æt. 30, tasted a liquid which had een used for flavouring pastry, and perceiving that it was very acrid on her ongue and lips, spat it out immediately and washed her mouth with water. he thought she could not have swallowed more than a drop, but in replacing ne bottle she spilled about a tablespoonful on the table and did not imme- ately wipe it up. The vapour strongly impregnated the small room in which ne was, and produced a feeling of sickness in another servant. The burning ste in the mouth was immediately followed by a sensation of numbness and ngling in the tongue and lips, and a strange feeling for the next hour. As e woman became worse, Mr. Fotherby was called in, and saw her in an hour d three-quarters after the occurrence. Her aspect was then quite typical of ussic acid poisoning;—the eyes were bright and glassy, the features pale d ghastly, the lips and nails purple, as if stained by blackberries, the skin s clammy, and the pulse feeble. Her mind was then clear, and she scribed how the accident had occurred and what her sensations were. She s able to swallow a mustard emetic, after which she became rapidly worse, st her consciousness, the teeth became set, the hands clenched and blue, the uscles rigid and convulsed. She vomited freely a pale fluid matter which had e peculiar odour of nitrobenzole. The stomach-pump was used but the fluid shed out of the organ had hardly any odour, owing probably to the small quan- y actually swallowed, and its removal by absorption. The breathing became uch reduced, and the pulse could scarcely be felt. In about eleven hours ere was reaction, consciousness returned, and she was able to swallow. At the end of seventeen hours she was much better; but she then complained of distorted vision, with flashes of light and strange colours before her eyes. For some weeks she continued weak. It was at first supposed the woman had swallowed a larger quantity of the liquid than she had imagined; but it is obvious, from the entire absence of the odour in the fluid drawn off by the stomach-pump, within about two hours, that but little could have passed into the stomach. There is no doubt, from what has been observed in other cases, that these severe symptoms were chiefly due to the breathing of the vapour in a concentrated form. A fellow-servant who was in the room at the time the nitrobenzole was spilled, also suffered from the inhalation of the vapour. Mr. Fotherby sent me a portion of the liquid, and I found it to be pure nitrobenzole unmixed with any essential oil of almonds.

A case of poisoning by this liquid which was the subject of an inquest at Ramsey, in the Isle of Man, is reported in the 'Pharmaceutical Journal' for December 1862, p. 283. A clerk in some chemical works took, on the 6th of November, a few drops (supposed to have been fifteen) of nitrobenzole. Immediately afterwards he felt unwell and became insensible. Stimulants restored consciousness, but there was a relapse, and he died the next day. The following case occurred at the London Hospital:—A boy, æt. 17, while drawing off some nitrobenzole by a siphon, swallowed a portion of the liquid. There were no immediate symptoms, but he soon felt sleepy, and when at dinner ate but little, and said he felt as if he was drunk. This was between two and three hours after he had swallowed the liquid. He fell into a stupor which became deeper and deeper until death took place, without vomiting or convulsions, twelve hours after the ingestion of the poison. (Dr. Mackenzie in 'Med. Times and Gaz.,' 1862, vol. 1, p. 239.)

In a paper communicated to the Royal Society in 1863, Dr. Letheby describes this and another case which fell under his observation,—that of a man, æt. 43, who spilled a quantity of nitrobenzole over his clothes, and went about several hours, breathing an atmosphere saturated with the vapour. The effects were nearly the same in both cases; although in one the poison was inhaled in vapour, and in the other it was swallowed as a liquid. For some time there was no feeling of drowsiness in this man; gradually, however, his face became flushed, his expression stupid, and his gait unsteady; he had the appearance of a person who had been drinking. The stupor gradually increased, until it passed into profound coma, and in this state he died. The progress of each of the fatal cases was much the same as that of slow intoxication, excepting that the mind was perfectly clear, until the coming on of the fatal coma. This was sudden, like a fit of apoplexy; and from that moment there was no return of consciousness or bodily power: the sufferer lay as if in a deep sleep, and died without a struggle. The duration of each case was nearly the same. About four hours elapsed from the time of taking or inhaling the poison to the setting-in of the coma, and the coma lasted five hours. The *appearances* after death were—flushed face, livid lips, the superficial vessels of the body, especially about the throat and arms, were gorged with blood, which was everywhere black, and fluid. The dependent parts were turgid, the lungs somewhat congested; the cavities of the heart were full of blood; the liver was of a purple colour, and the gall-bladder distended with bile; the brain and its membranes were congested, and in the case of the man there was much bloody serosity in the ventricles. Nitrobenzole, as well as aniline, into which it appears to be partially converted in the body, was detected in the brain and stomach. ('Proc. Royal Soc. 1863,' No. 56, p. 550.) It is not stated what the result of the analysis, if any, was in reference to the case of death from the vapour, in which the poison was absorbed through the lungs. In performing some experiments on animals, Dr. Letheby found that the local action on the stomach was slight; there was rarely any vomiting, and there was either rapid coma, or a slow setting-in of paralysis and coma, after a long period of inaction. There was a complete loss of voluntary power, a spasmodic fixing of the muscles of the back, with violent struggles, a look of distress, and occasionally a kind of epileptic fit. The pupils were widely dilated, the action of the heart was irregular, and the breathing difficult. The time of death in the more rapid cases varied from twenty-five minutes to twelve hours after the administration of the poison. In other experiments, in which smaller doses were given, the time that elapsed between the administration of the poison and the coming-on of the first symptoms (an epileptic fit), varied from nineteen to seventy-two hours; in most cases it was about two days, and the time of death was from four to nine days. The appearances were similar to those already described. When death had taken place within twenty-four hours, the odour of the nitrobenzole was clearly perceptible in the stomach, brain, and lungs; and aniline (from the chemical conversion of nitrobenzole) was found in the organs. In the slower fatal cases the odour had often entirely disappeared: but traces of aniline could be detected in the brain and urine, and sometimes in the stomach and liver. Occasionally no poison was found, although death had taken place from the poison!

This narcotic compound differs from the ordinary narcotics in its powerful and persistent odour, which would render it difficult for a person to administer it, either in liquid or vapour, unknowingly to another; in the production of profound coma at an uncertain interval after the stupor; and in the rapidly-fatal effects when coma has followed. It operates powerfully as a poison in vapour as well as in a liquid state; but so far as cases have yet been observed in the human subject, the symptoms resembling those of the first stage of narcotic poisoning have very soon appeared. The rapidly-fatal cases only would be likely to be mistaken for apoplexy, but in these the poison would be detected by its odour.

Analysis.—Nitrobenzole or Essence of Mirbane is a pale lemon-coloured liquid of a strong odour resembling that of bitter almonds. It has a pungent hot disagreeable taste. It gives to confectionery the smell but not the pleasant taste of oil of bitter almonds. It destroys the colour of litmus, and gives a greasy stain to paper, leaving a yellow mark when the stain disappears. It sinks in water, and is partly dissolved, giving to it a yellowish colour. It is soluble in alcohol, ether, and chloroform, but when agitated with water, it is in great part separated from its ethereal and chloroformic solutions. It has no basic qualities; its aqueous solution is not precipitated either by tannic acid or the chloriodide of mercury and potassium. It is highly combustible, burning with a yellow smoky flame. It yields no Prussian blue when mixed with sulphate of iron, alcohol, and potash, and its vapour produces no cyanide of silver in a solution of the nitrate. It is distinguished from all other liquids, excepting the essential oil of almonds, by its odour, and from this oil by the following test:—Pour a few drops of each on a plate and add a drop of strong sulphuric acid. The oil of almonds acquires a rich crimson colour with a yellow border, the nitrobenzole produces no colour. In order to separate it from organic liquids, they may be acidulated with sulphuric acid, and submitted to distillation in an apparatus similar to that which is described at page 208. If any of it exists in a free state, its odour will be sufficient for detecting its presence. If converted into aniline, another process will be required. There is no probability that this liquid will be successfully employed for the purposes of murder without the certainty of detection.

ANILINE.

This is a narcotic poison in liquid or vapour resembling nitrobenzole in its toxicological effects. Schuchardt found that a small rabbit was killed by sixty drops in six hours and a quarter, and a large rabbit by one hundred drops in four hours. There was loss of sensibility with loss of heat, and violent clonic and tonic convulsions ensued which continued until death. From experiments hitherto performed, it does not appear to be an active poison as a liquid, and it seems to affect the spinal marrow more than the brain. It has also a local irritant action. Dr. Turnbull gave half a drachm of the sulphate to a dog. In two hours and a half, the animal vomited, and an hour later it was purged. It became dull, weak, and tremulous; the pulse was rapid, and the breathing laboured. The feet were cold, the hind legs paralyzed, and the tongue was of a blue colour. In five hours the symptoms abated, and the next day the animal had recovered. ('Lancet,' Nov. 16, 1861.)

Dr. Letheby found that aniline given to dogs and cats in doses of from twenty to sixty drops, caused a rapid loss of voluntary power. The animal staggered and fell upon its side powerless, the head was drawn back, the pupils were dilated, the breathing was difficult, and the action of the heart tumultuous; there were slight twitchings or spasms of the muscles, and the animal quickly passed into a state of coma, from which it did not recover, death taking place in from half an hour to thirty-two hours. On inspection, the brain and its membranes were congested, the cavities of the heart were nearly full of blood, and the lungs but slightly congested. The blood all over the body was black and coagulated. The poison was easily discovered in the brain, the stomach, and the liver, although it was found that, as nitrobenzole is changed into aniline, so in some cases aniline and its salts are converted into mauve or magenta. This arises from the oxidation of the salts, and it has been especially observed on the surface of the body. ('Proc. Royal Society,' No. 56, 1863, p. 556). There is no instance recorded of the effects of aniline as a poison on the human body. It is a liquid of nauseous odour and taste, and could hardly be taken or administered without the consciousness of the person taking it. The salts appear to have very little action. They have been used medicinally in large doses without producing any unusual effects. In one case 406 grains of the sulphate of aniline were given to a patient in the London Hospital, in the course of a few days, without any symptoms of poisoning. (Dr. Letheby, loc. cit. See also cases by Dr. Fraser, 'Med. Times and Gazette,' March 8, 1862, p. 239.) It is difficult to suppose that combination with an acid to form a perfectly soluble salt can render aniline inert, as this would be contrary to experience in reference to other bases, e. g. nicotina and conia: at the same time, if we except the action of the vapour, no case has occurred which will enable us to solve the question.

There are facts which show that the *vapour* of aniline, even when much diluted, exerts a poisonous effect on man. Mr. Knaggs met with a case in which a workman accidentally broke a carboy containing a large quantity of this liquid; the aniline fell over him, but none entered his mouth. In his anxiety to wipe up the aniline, he respired the vapour for some time, felt giddy, and complained of his head and chest. When seen some hours after the accident his face and body were of a livid leaden hue, the lips, gums, tongue, and eyes of a corpse-like bluish pallor, he was breathing by gasping, and appeared at the point of death. There was no convulsion; he was sensible, and able to give a correct account of his feelings. His pulse was small and irregular. Under active treatment he recovered. ('Pharm. Jour.,' July 1862, p. 42.)

Dr. Letheby relates the following case :—In June 1861, a boy, æt. 16, was brought into the London Hospital in a semicomatose condition. In scrubbing out an aniline vat he had breathed the vapour; and although he did not suffer pain or discomfort at the time, he was suddenly seized with giddiness and insensibility. When brought to the hospital he looked like a person in the last stage of intoxication; the face and surface of the body were cold, and the pulse was slow and almost imperceptible, the action of the heart was feeble, and the breathing heavy and laborious. After rallying a little, he complained of pain in his head and giddiness. His face had a purple hue, and his lips, the lining membrane of his mouth, as well as his nails, had a similar purple tint. On the next day the narcotic symptoms had passed away, but he was remarkably blue, and looked like a patient in the last stage of cholera. These cases appear to show that aniline vapour is less poisonous than that of nitrobenzole, and that the symptoms follow more rapidly on the inhalation of the vapour. For a full account of the effects of aniline on animals, I must refer the reader to a pamphlet by Dr. Sonnenkalb of Leipsic, —'Anilin und Anilin-farben in toxikologischer und medicinalpolizeilicher Beziehung,' Leipzig, 1864, p. 20. The injurious effects to public health likely to arise from the employment of aniline colours in confectionery and cosmetics, are also fully described in this essay.

Analysis.—Commercial aniline is an oily liquid of a reddish-brown colour, with a peculiar tarry odour. It produces a volatile greasy stain on paper. It is volatile and combustible, burning with a thick smoky flame. It falls to the bottom of water, and does not readily dissolve in it. It is quite soluble in alcohol and ether, but not in chloroform: in the latter property it differs from nitrobenzole. Diluted sulphuric acid combines with it to produce a white compound which is quite soluble in water. A solution of chloride of lime added to the acid watery liquid produces a splendid colour of various shades of purple and red.

The solution of sulphate of aniline is not precipitated either by tannic acid or chloriodide of mercury and potassium, but aniline itself in the small quantity in which it is dissolved by water yields like the alkalies a yellow precipitate with arsenio-nitrate of silver. It also reduces completely a solution of chloride of gold—precipitating metallic gold. A minute quantity of aniline may be thus detected. When pure aniline is heated with powdered corrosive sublimate, it produces a rich crimson dye. When present in organic liquids, aniline may be separated by digesting the concentrated liquid in alcohol, mixed with a little diluted sulphuric acid. The alcoholic extract, distilled at a high temperature with a solution of potash, yields aniline in the receiver. This may be tested by the methods above described.

OIL OF WORMWOOD.

I am indebted to Mr. W. Smith, surgeon to the Chesterfield Hospital, for the report of a case of poisoning by this liquid, which, so far as I know, is the only instance on record of its noxious effects on man.

A druggist's shopman was found early one morning by his master, lying on the floor of the shop, perfectly insensible, convulsed, and foaming at the mouth. As the man had never suffered from fits, and the symptoms were of an alarming character, Mr. Smith was at once sent for. He found him no longer violently convulsed, but insensible; the jaws were clenched, and the pupils dilated. The pulse was weak, slow, and compressible. From time to time he uttered incoherent expressions, and attempted to vomit. With some difficulty Mr. Smith administered to him repeated doses of stimulants, sal volatile and water, lime water, and an emetic of mustard and sulphate of zinc. Free vomiting ensued, and consciousness partially returned. Artificial warmth was applied to the limbs, and a little brandy and water given at intervals, with draughts of milk and lime water. He gradually recovered. The matters vomited smelt strongly of oil of wormwood, and the nature of the poison was placed beyond doubt by the discovery of the bottle, with marks on its mouth of the oil having been recently poured out. The druggist stated that at least half an ounce had been taken. From the persistent smell of the oil in the ejected matters, after repeated vomiting, it is probable that this was even less than the real quantity. The man, on recovering, had totally forgotten all the circumstances connected with the case, and persisted in stating that he knew no reason why he should have taken it. It is, however, probable that he imagined himself suffering from worms, and sought relief in an unusual dose of this oil. (See 'Ann. D'Hyg.' 1863, i. 227.)

NITROGLYCERINE (GLONOINE).

This is a powerfully explosive liquid, well known to chemists as a substitution-compound of the innoxious liquid glycerine, obtained in the process of saponification. It has a sweet aromatic pungent taste, and it is stated that a single drop placed on the tongue produces a painful aching in the back of the head which lasts for some hours. ('Miller's Chemistry,' vol. 3, p. 277.) Mr. Field states that he found one drop of the liquid dissolved in water produced insensibility and other symptoms of narcotic poisoning, ('Chem. News,' Nov. 7, 1863. According to Mr. Merrick, its vapour acts powerfully as a narcotic poison, and even when much diluted with air, it produces intense headache. Other experimentalists have not observed these extraordinary effects, and are inclined to regard it as inert, or at any rate they consider that its narcotic properties have been greatly exaggerated. Some support has been given to this last opinion by the fact, that the liquid has been used by homœopathists under the name of glonoine, and the effects said to have been produced by infinitesimal doses, are of so marvellous a character, as to justify utter incredulity. Like other liquids described in this chapter, it probably acts most powerfully by its vapour, but further observations of a trustworthy kind are required to determine its potency as a poison.

Professor Vrij of Rotterdam has prepared this liquid in large quantities, and has examined its chemical and physiological properties. Sobrero, who discovered it in 1847, stated that the smallest quantity was sufficient to produce the most violent headache, and he concluded from this that it was a powerful poison. Professor Vrij found that the vapour caused intense headache, but that it had no poisonous properties. He gave two drops to a rabbit, and no symptoms of poisoning were produced. ('Pharm. Journal,' 1855-6, p. 229.)

Analysis.—Nitroglycerine is a heavy oily-looking liquid. It is dissolved by water, but is insoluble in alcohol and ether. It explodes violently either by a blow, or by the application of heat.

CHAPTER 27.

ALCOHOL — ETHER — CHLOROFORM — CAMPHOR — TOBACCO — NICOTINA — COCCULUS INDICUS — PICROTOXINE — DARNEL SEEDS — CALABAR BEAN — FUNGI — HENBANE —LACTUCARIUM—SOLANUM.

ALCOHOL.

Symptoms.—In general, the symptoms produced by alcohol come on in the course of a few minutes. There is confusion of thought, with inability to stand or walk, a tottering gait and giddiness, followed by stupor and coma.

Should the person recover from this stage, vomiting supervenes. The insensibility produced by alcohol may not come on until after a certain period and then suddenly. Dr. Christison met with an instance in which a person fell suddenly into a deep stupor, some time after he had swallowed sixteen ounces of whisky—there were none of the usual premonitory symptoms. In another instance, a person may apparently recover from the first effects,—then suddenly become insensible and die convulsed. There is a ghastly or vacant expression on the features, which are sometimes suffused and bloated, the lips are livid, and the pupils are dilated and fixed; if they possess the power of contracting under the influence of light, it is a favourable sign. (See case in 'Lancet,' Jan. 27, 1855, p. 89.) The conjunctivæ or whites of the eyes are generally much suffused. The breath has an alcoholic odour. The more concentrated the alcohol, the more rapidly are the symptoms induced, and they are also more severe in their character. Diluted alcohol commonly produces a stage of excitement before stupor, while in the action of concentrated alcohol there may be profound coma in a few minutes. The cause of death may be generally traced to congestion of the brain or lungs or both. Alcohol may act as a poison by its *vapour*. If the concentrated vapour be respired, it will produce the usual effects of intoxication. There is a case on record in which a child two years of age was thrown into an apoplectic stupor by the alcoholic vapour of eau de Cologne. In this manner a child might be destroyed, and no trace of the poison found in the stomach.

The symptoms arising from apoplexy, from concussion of the brain, or the effects of opium, have been sometimes mistaken for those of poisoning by alcohol, and persons have been wrongly charged with being drunk. With respect to *concussion*, a difficulty can arise only in reference to the more advanced stage of poisoning by alcohol, *i. e.* in which there is profound coma. Intoxication may in general be easily distinguished by the odour of the breath, for so long as the symptoms continue, the alcohol is eliminated by the lungs. If there should be no perceptible odour of any alcoholic liquid, the presumption is that the symptoms are not due to intoxication. When the alcoholic odour is perceptible, the symptoms may still be combined with the effects of apoplexy or concussion—a fact which can be cleared up only by a history of the case, or a careful examination of the head for marks of violence. In poisoning by *opium* there will be a strong smell of this drug in the breath, the symptoms come on much more gradually, and are marked by drowsiness and stupor, passing into complete lethargy, with general relaxation of the muscles, and nability to walk. In poisoning by alcohol there is either great excitement some time before the stupor, which comes on suddenly, or the person is found n a state of deep coma a few minutes after having taken the poison. In poisoning by opium the face is pale, and the pupils are contracted:—in poisoning by alcohol the face, especially if there be excitement, is more commonly flushed, and the pupils are generally dilated. Another fact to be noticed is, that while perfect remissions are rare in poisoning by opium,—in poisoning by alcohol a person frequently recovers his senses and dies subsequently. When coma has supervened, the patient may be roused by a loud noise or a violent shock in either case, and it is very difficult under these circumstances to draw a well-marked distinction. The odour of the breath, or an examination of the fluid drawn from the stomach by the pump, may then show which poison has been taken: but the treatment is the same in both cases.

Appearances.—The stomach has been found intensely congested or inflamed, the mucous membrane presenting in one case a bright red, and in another a dark red-brown colour. When death has taken place rapidly, there may be a peculiar odour of spirits in the contents; but this will not be perceived if the quantity taken was small, or many hours have elapsed before the inspection is made. The brain and its membranes are found congested, and, in some instances, there is effusion of blood or serum beneath the inner membrane. In a case, observed by Dr. Geoghegan, in which a pint of spirits had been taken, and proved fatal in eight hours, black extravasation was found on the mucous membrane of the stomach; but no trace of alcohol could be detected in the contents. ('Dub. Med. Press,' i. 293.) The action of a strong alcoholic liquid on the mucous membrane of the stomach so closely resembles the effects produced by arsenic and other irritants, as easily to give rise to the suspicion of mineral irritant poisoning. A drawing in the Museum collection of Guy's Hospital, furnishes a good illustration of the local action of alcohol. The whole of the mucous membrane of the stomach is highly corrugated and is of a deep brownish-red colour. Of all the liquids affecting the brain, this has the most powerful local action on the stomach. A case of alcoholic poisoning of a child, æt. 7, referred to me by Mr. Jackaman, coroner for Ipswich, in July, 1863, will serve to show the correctness of this remark. A girl was found at four o'clock in the morning lying perfectly insensible on the floor. She had had access to some brandy which she had swallowed from a quartern measure found near her quite empty. She had spoken to her mother only ten minutes before, so that the symptoms must have come on very rapidly. She was seen by Mr. Adams four hours afterwards. She was then quite insensible, in a state of profound coma, the skin cold and covered with a clammy perspiration. There had been slight vomiting. The child died in twelve hours, without recovering consciousness from the time at which she was first found. On inspection, there was congestion of the brain and its membranes: the heart and lungs were quite healthy. The mucous membrane of the stomach presented patches of intense redness, and in some places it was thickened and softened; portions of it were detached and hanging loosely in the stomach; and there were patches of black extravasation about it, evidently from altered blood. It contained a greenish-coloured liquid, but there was no smell of brandy in it, neither was this perceptible in the breath of the child, four hours after the alcoholic liquid had been taken. At first it was suspected that arsenic had been administered, but the symptoms were not those of arsenical poisoning, and neither arsenic nor any other metallic irritant was present in the contents of the stomach, but slight traces of the vapour of alcohol were detected by the process described below.

Analysis.—When a large dose has been taken and the case has proved rapidly fatal, the contents of the stomach may have the odour of alcohol, or of the alcoholic liquid taken. The odour is not always perceptible, or it may be concealed by other odours. In a case of poisoning by gin, the liquid drawn from the stomach by the pump in seven hours had no odour. In the case of the child above related, the smell of brandy had entirely disappeared in twelve hours. The whole of the contents or of the suspected liquid should be distilled in a water-bath, with a proper condensing apparatus attached. If the liquid has an acid reaction, it should be first neutralized either by a solution of carbonate of potash, or soda. The watery liquid obtained should be mixed with chloride of calcium or anhydrous sulphate of copper, in sufficient quantity, and submitted to a second distillation in a smaller retort, in a water-bath. The liquid obtained by the second distillation should be agitated with rather more carbonate of potash than it will dissolve, in a small tube provided with a stopper, and allowed to stand. A stratum of alcohol, if present, will, after a time, float on the surface, and may be drawn off by a pipette and examined. *Tests.*—1. Alcohol has a hot pungent taste, a peculiar odour, and is very volatile. 2. Absorbed in asbestos, it burns with a pale blue flame, which deposits no carbon on white porcelain;

and when burnt in the mouth of an inverted test-tube, containing a few drops of solution of baryta, it produces a well-marked deposit of white carbonate of baryta. Lime water may be substituted for baryta in this experiment. Carbonic acid and water are the sole products of its combustion. 3. It dissolves camphor. 4. It sets free green oxide of chromium when boiled with a few drops of a saturated solution of bichromate of potash mixed with sulphuric acid. (Dr. Thomson, in 'Monthly Jour. Med. Science,' Dec. 1846, p. 412.)

The following method will allow of the detection of a quantity of alcohol too small for separation by the process above mentioned. Make a mixture of strong sulphuric acid and a saturated solution of bichromate of potash: moisten with this mixture a few fibres of asbestos, and inclose them in a glass tube connected with the retort or flask in which distillation is carried on. For this purpose a flask and tube similar to those used for the detection of chloroform vapour will be found serviceable (see page 319). The smallest portion of alcohol-vapour passing over the asbestos, immediately renders it green, by converting the chromic acid to oxide of chromium. This may serve as a trial test or for evidence, according to circumstances. The tube may be removed, and the condensed vapour collected for the application of the other tests. Ether and pyroxylic spirit produce a similar result.

From lapse of time, the effects of treatment, or absorption and elimination, there may be no trace of alcohol in the stomach or intestines, nevertheless the person may have died from the effects. In a case, fatal in eight hours, which occurred to Dr. Geoghegan, no alcohol was found in the stomach (p. 316). One cause of failure may sometimes be traced to the distillation being restricted to a portion of the contents. It is advisable to distil the *whole*, as, if necessary, the distillate or the residue can be examined for other poisons.

ETHER.

Symptoms and Effects.—Ether, in moderate doses, has a hot burning taste, and produces during swallowing a sense of heat and constriction in the throat. It causes, like alcohol, great excitement and exhilaration, with, subsequently, intoxication, but persons may become habituated to it, and thus after a time it may be taken in very large quantities with comparative impunity. The effects produced on the system, when a large dose has been taken, are not unlike those occasioned by alcohol. Orfila found that about half an ounce of sulphuric ether, administered to a dog, caused, in a few minutes, a disposition to vomit. This was followed by giddiness, and in ten minutes by an entire loss of power in the muscles. The breathing was painful and hurried, but there were no convulsions. After a slight abatement in the symptoms, the dog fell into a state of insensibility and died in three hours. The whole of the mucous membrane of the stomach was of a blackish-red colour, and with the other coats intensely inflamed. There was slight inflammation of the duodenum; but the rest of the alimentary canal was in a healthy condition. The heart contained black blood partly coagulated: the lungs were gorged with fluid blood. (Op. cit. ii. 531.) Ether as a liquid has not, so far as I know, destroyed life: but when its vapour has been breathed it has caused death in several instances. (See 'ON POISONS,' 2nd Ed. p. 731.

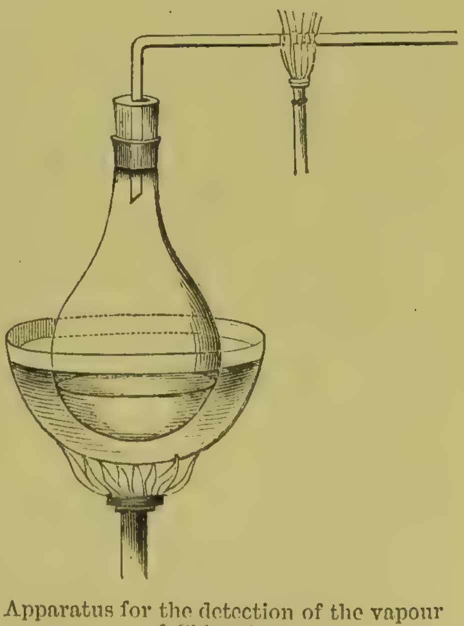
Analysis.—When ether has been taken as a liquid and has caused death, it may be separated from the contents of the stomach by the process described for alcohol. The chromic acid process applied to the vapour during distillation will enable the analyst to detect a minute quantity; and, by its peculiar odour, ether may be easily distinguished from alcohol or pyroxylic spirit. 1. Ether is highly inflammable, and burns with a yellow smoky flame, producing carbonic acid and water. 2. When shaken with its bulk of water, only a small portion is dissolved, the rest floats on the surface. If taken in a liquid form, it may be separated from the contents of the stomach by distillation, and the product rectified by redistillation with carbonate of potash at a temperature of about 120°.

CHLOROFORM.

Symptoms.—This liquid, when taken in a large dose, appears to affect the system like alcohol: but as a *liquid* it cannot be regarded as an active poison. I have elsewhere recorded a case communicated to me by Mr. Jackson, of Sheffield, in which a man swallowed *four ounces* of chloroform. He was able to walk for a considerable distance after taking this dose, but he subsequently fell into a state of coma—the pupils were dilated, the breathing was stertorous, the skin cold, the pulse imperceptible, and there were general convulsions. He recovered in five days. ('Med. Gaz.,' vol. xlvii. p. 675.) A private in a cavalry regiment in the United States swallowed nearly two ounces of chloroform. He was seen ten or fifteen minutes afterwards; he had already vomited, and was found insensible, with stertorous breathing, and a pulse of about 60. The stomach-pump was employed, and some spirits of ammonia were injected. The pulse became more feeble, the breathing slower, and the pupils were insensible to light. The surface was cold, and for a time he continued to get worse, the face becoming purple, while the pulse was intermittent and hardly discernible. Two hours and a half after taking the poison, however, a gradual improvement commenced, but sensibility did not return until four hours later. For several days he continued to suffer from great irritability of the stomach, and eventually he had an attack of jaundice. ('Amer. Journ. Med. Science,' Oct. p. 367; 'Med. Times and Gazette,' Nov. 28, 1857, p. 558.) In two cases, alarming symptoms have been produced by much smaller doses, and one of these proved fatal. In March, 1857, a lady swallowed half an ounce of pure chloroform. In five minutes she was quite insensible, generally convulsed, the jaws clenched, the face slightly flushed, the pulse full and rather oppressed, and she foamed at the mouth. She vomited, and in twenty minutes the convulsions had left her; soon afterwards she had a relapse, and did not recover for twenty-four hours. ('Med. Times and Gaz.,' Dec. 12, 1857, p. 615.) The symptoms in this case appear to have been mixed with those of hysteria and epilepsy. The following case communicated to me by Mr. Thursefield, of Brosely, in March, 1854, is a clear case of poisoning by liquid chloroform. A boy, æt. 4, was brought to him by his father in a state of total insensibility. It appears that he had swallowed a *drachm* of chloroform, and soon afterwards laid his head on his mother's lap and lost all consciousness. Mr. Thursefield saw him about twenty minutes afterwards. He was then insensible, cold, and pulseless. Mustard plasters were applied to the legs; they acted well, but produced no impression on the sensibility. His breathing varied; it was sometimes natural, at other times stertorous. He became warmer, his pulse full and regular; and he continued *three hours* in this state, when he died quite calmly without a struggle, in spite of every effort made for his recovery. This is the smallest dose of liquid chloroform that has destroyed life.

Chloroform Vapour.—The vapour when respired in a concentrated form, is speedily fatal to life. If it is diluted with a certain proportion of air, it produces insensibility, with entire loss of muscular power in from eight to ten minutes, and the patient speedily recovers after the vapour is withdrawn. Cases of death from the inhalation of the vapour for surgical purposes are now very numerous, and the symptoms and post-mortem appearances are well-marked. (See 'ON POISONS,' 2nd Edit. p. 738; also 'Lancet,' April 16, 1859, p. 400, and April 23, p. 425.) In some instances death has taken place within two minutes from the commencement of inhalation. In one in which only thirty drops had een taken in vapour, the patient died in one minute, and in another, so small quantity as fifteen or twenty drops proved speedily fatal. (' Table of Fatal ases ' by Dr. Warren, U.S. p. 23.) Chloroform, therefore, operating through e lungs, has destroyed life more rapidly, and in a smaller dose, than any other oison known. Its fatal operation is sometimes suddenly manifested after the ithdrawal of the vapour, apparently by an accumulative effect on the blood. one case witnessed by a friend, the heart suddenly ceased to beat four inutes after the vapour had been withdrawn. The digital arteries which d been divided in the operation suddenly ceased to bleed. The man was ead. The fatal effects are generally ascribed to idiosyncrasy or to the unforeen condition of a fatty or flabby heart. Admitting this to be to some extent e true cause of the fatality, it cannot be denied that fatty and flabby hearts ve become very common, since the introduction of chloroform-vapour for rgical and other purposes. In cases of alleged robbery and rape, it has been metimes stated that the person assaulted was rendered suddenly insensible by loroform; but chloroform vapour does not produce immediate insensibility, less it also produces asphyxia and death. Mr. Stevenson found that in ore than two hundred cases of its administration at Guy's Hospital, adults ere not commonly rendered insensible until after the lapse of eight minutes, e dose being three and a half drachms given in half-drachms. In March 63, a woman, æt. 40, took ten drachms in thirty-three minutes, in halfachms, and was still conscious and able to talk.

Analysis.—Chloroform is a heavy colourless liquid (sp. gr. 1·484), neutral its reaction, sinking in water in globules, and only to a slight extent ssolving in that liquid. It has a fragrant odour like that of apples; it dissolved by alcohol and ether. It is very volatile, but not combustible. ke alcohol it dissolves camphor. Nitric and sulphuric acids produce no ange in it. It boils at 140°, and evolves a vapour which at a red heat is olved into chlorine and hydrochloric acid. On this effect a process has en suggested for separating it from the *blood and tissues* when it has proved al in the form of vapour. The substance supposed to contain chloroform placed in a flask, like that shown in the nexed illustration. The neck of the flask fitted with a cork perforated to admit a d glass tube, bent at right angles and ing a length of from twelve to fifteen hes. The flask is gradually plunged into er at about 160°, and at the same time, middle portion of the tube is heated to redness by an air-gas jet. At a red heat, oroform vapour is decomposed, and chlorine hydrochloric acid are among the products ts decomposition. Litmus paper applied he mouth of the tube, is reddened: starch er wetted with iodide of potassium, is lered blue, and nitrate of silver is preitated white. Two drops of pure chloron were thus readily detected, and so sistent was the vapour in the closed vessel, it was detected after one, two, and even e weeks. Two drops added to a quantity of putrefied blood were detected a similar process after a fortnight, the flask being closed, but the mouth he tube remaining exposed to air. This method of detecting chloroform its products, appears to be quite satisfactory. In practice, however, it be found a very difficult matter to detect it, even where we know it has


Apparatus for the detection of the vapour of Chloroform.

been administered. Some years since, in conjunction with the late Dr. Snow, I examined by this process the blood of a boy who had died in Guy's Hospital from the effects of chloroform vapour, but without detecting any trace of it. There was no odour in the blood, and the result was negative. In 1863, I examined the blood of three persons, taken while they were under the full operation of chloroform, and collected in closely-stopped glass bottles. One of the samples, examined within half an hour after removal from the living body, had no odour of chloroform, and gave not the slightest indication of its presence. The two other samples kept in close bottles until tested, forty-eight hours after removal, did not contain a trace of chloroform vapour. Either the quantity in a few ounces of blood is too small for detection, or it is rapidly lost by its volatility, or it is converted in the blood into formic acid or some other product.

As chloroform is much more volatile than ether, and its odour is not so pungent, it is not so easily detected in the dead body by the smell. The body should be inspected as soon as possible, and any solids or liquids intended for examination should be placed in well closed glass vessels. If the smell can still be perceived in the blood or organs, the vapour may be easily detected by the method above described. Chloroform, if not eliminated or lost by its volatility, may have been converted in the blood into formic acid, and thus removed from the ordinary processes of chemistry.

CAMPHOR.

There are but few instances recorded in which camphor has proved fatal in the human subject: but it has on several occasions produced alarming symptoms, and would probably have destroyed life, had it not been early removed from the stomach. In the few cases that have been observed, its effects were somewhat different.

Symptoms and Appearances.—Camphor operates on the brain and nervous system. In one instance, in which it proved fatal, a woman swallowed in the morning about *twenty grains* of camphor dissolved in rectified spirits of wine and mixed with tincture of myrrh. In half an hour she was suddenly seized with languor, giddiness, occasional loss of sight, delirium, numbness, tingling and coldness of the extremities so that she could hardly walk. The pulse was quick and respiration difficult, but she suffered no pain in any part. On the administration of an emetic, she vomited a yellowish liquid smelling strongly of camphor. In the evening, the symptoms were much diminished, but she had slight convulsive fits during the night. The next day she was convalescent; the difficulty of breathing, however, continued more or less for several weeks. This is the smallest dose of camphor which appears to have been attended with serious symptoms in an adult. In January 1863, an infant of fifteen months died from the effects of some camphorated oil given to it by mistake. Convulsions ensued and death took place in thirteen hours. Three cases of poisoning by camphor are reported by Dr. Schaaf, one of which proved fatal. A woman gave about thirty grains (half a teaspoonful) of powdered camphor to each of her three children as a vermifuge. Two of the children were respectively of the ages of three or five years, the third was an infant aged eighteen months. The first symptoms were paleness of the face with a fixed and stupid look. Delirium followed, with a sense of burning in the throat, and great thirst. Vomiting, purging, and convulsions supervened, and in one child the convulsions were most violent. The two elder children. after suffering thus for three hours, fell into a comatose sleep, and on awaking the symptoms passed off. The infant died in seven hours, not having manifested any return of consciousness from the first occurrence of convulsions. ('Journal de Chimie Médicale,' 1850, p. 507.) The severity of the symptoms s fully explained by the large quantity administered and the age of the hildren. In a dose of one drachm given in a clyster, camphor produced larming symptoms. ('Med. Gaz.' vol. 48, p. 552.) In a case reported in ie Medical Gazette (vol. 11, p. 772), 120 grains were taken by a physician, nd all that he experienced was lightness in the head with great exhilaration. here was no derangement of the stomach or bowels. He slept profoundly r some hours, and awoke very weak and exhausted. He also perspired reatly during his sleep. It is difficult to draw any conclusion from this case, s the quantity taken was conjectural, and the patient was not seen by any erson while labouring under the effects of the poison. A soldier took a rge quantity of camphor daily. For three days it had no effect upon him. n the fifth day, he suffered from great pain and a burning sensation in the omach. His head was painful: there was giddiness with an incessant desire walk about, although, like a drunken man, he could hardly keep on his gs. He soon fell completely insensible—his limbs were cold, his face was ile, his body convulsed, and the pupils were dilated. These symptoms ere followed by an irresistible desire to sleep. In two or three days he covered. ('Med. Times and Gaz.' Dec. 1858, p. 645.)

A case of poisoning by camphor would be recognized by the odour of the eath, a symptom which would attract the attention of a non-professional rson. The presence of this substance in the stomach would be at once incated by its odour.

Tobacco.

Symptoms.—The effects which this substance produces, when taken in a ge dose, either in the form of powder or infusion, are well-marked. The mptoms are faintness, nausea, vomiting, giddiness, delirium, loss of power in e limbs, general relaxation of the muscular system, trembling, complete ostration of strength, coldness of the surface with cold clammy perspiration, nvulsive movements, paralysis, and death. In some cases there is purging, th violent pain in the abdomen; in others there is rather a sense of sinking depression in the region of the heart, passing into syncope, or creating a ase of impending dissolution. With the above-mentioned symptoms there is atation of the pupils, dimness of sight, with confusion of ideas, a small, ak and scarcely perceptible pulse, and difficulty of breathing.

Poisoning by tobacco has not often given rise to medico-legal discussion. is is the more remarkable, as it is an easily accessible substance, and the ssession of it would not, as in the case of other poisons, excite surprise or picion. In June 1854 a man was charged with the death of an infant 10 weeks by poisoning it with tobacco. He placed a quantity of tobacco the mouth of the infant, with the view, as he stated, of making it sleep. The nt was completely narcotized and died on the second day. It is probably re extensively used to aid the purposes of robbers than is commonly ieved; and there is reason to suppose that porter and other liquors sold in thels, are sometimes drugged either with tobacco or with snuff prepared m it. Scotch snuff is said to be used for this purpose. Tobacco owes its sonous properties to the presence of a liquid volatile alkaloid, *Nicotina*.

NICOTINA.—This is a deadly poison, and like prussic acid it destroys life in ll doses with great rapidity. I found that a rabbit was killed by a gle drop in three minutes and a half. In fifteen seconds the animal lost all ver of standing, was violently convulsed in its fore and hind legs, and its k was arched convulsively (opisthotonos). A frothy alkaline mucus ped from its mouth having the odour of nicotina. ('Guy's Hospital Rets,' Oct. 1858, p. 355.) A case of poisoning by this alkaloid which occurred Belgium in 1851, was the subject of a trial for murder. ('Ann. d'Hyg.'

1851, 2, pp. 167 and 147). The *Count* and *Countess Bocarmé* were charged with the murder of the Countess's brother, a *M. Fougnies*, by administering to him nicotina while he was dining with them at the Château of Bitremont. The poison was forcibly administered. The deceased did not survive more than five minutes, and was not seen living by any of the attendants. The possession of the poison, as well as the moral evidence, fixed the crime on the Count, and he was condemned and executed. The appearances after death were to a great extent altered or destroyed by the pouring of some strong acid (acetic) into the mouth and over the body of the deceased, in order to conceal or remove the odour of nicotina. M. Stas detected the poison in small quantity in the tongue, throat, stomach, liver, and lungs of the deceased, as well as in a wooden plank of the floor near to which he was sitting. A second case of poisoning by this alkaloid, and the only case recorded in this country, occurred in London as an act of suicide in June 1858. A gentleman swallowed a quantity of nicotina from a bottle, and almost immediately afterwards was seen in the act of falling to the floor. He was carried to an adjoining room, but before this could be reached, he was dead. The symptoms noticed were that deceased stared wildly: there were no convulsions, and he died quietly, heaving a deep sigh in expiring. In producing these effects nicotina resembles prussic acid. The quantity of nicotina taken, could not be determined. The deceased appears to have been rendered immediately insensible, and to have died in from three to five minutes, after having taken the poison. The *appearances* observed were a general relaxation of the muscles, prominent and staring eyes, bloated features, great fulness, with lividity about the neck. There was no odour resembling nicotina or tobacco perceptible about the body. When examined between two and three days after death, putrefaction had occurred especially in the course of the veins. The swelling of the neck was found to arise from an effusion of dark liquid blood. The scalp and the membranes of the brain were filled with dark-coloured blood. The lungs were engorged and of a dark purple colour. The cavities of the heart were empty, with the exception of the left auricle, which contained two drachms of dark-coloured blood. The stomach contained a chocolate-coloured fluid (reserved for analysis): the mucous membrane was of a dark crimson red colour from the most intense congestion. There was no odour excepting that of putrefaction. The liver was congested and of a purple black colour. The blood throughout the body was black and liquid, but in some parts it had the consistency of treacle. I found nicotina in small quantity in the contents of the stomach, also in the liver and lungs; but as these organs had been placed in contact with the stomach, it could not be inferred that the poison had been absorbed and deposited in them.

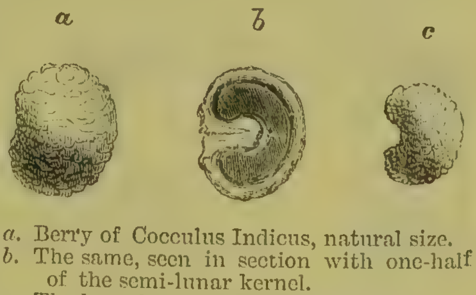
Analysis.—A sample of nicotina which I examined had a pale amber colour, and evolved a peculiar acrid odour, affecting the nose and eyes, resembling when diluted that of stale tobacco smoke. It had the consistency of a thin oil, gave a greasy stain to paper, which soon disappeared, owing to its volatility. When heated on platinum or on paper it burnt with a bright yellow flame, emitting a thick black smoke. It was powerfully alkaline, and imparted a strong alkaline reaction to water without readily dissolving in it. The aqueous solution, even when much diluted, retained the peculiar odour. Nicotina is dissolved by alcohol and ether, and the latter liquid will remove it from its aqueous solution. 1. Chloride of platinum produces in the aqueous solution an orange yellow crystalline precipitate. 2. Corrosive sublimate gives a white precipitate. 3. Arsenio-nitrate of silver gives a yellow precipitate. In all these characters nicotina resembles ammonia: the differences, apart from the odour, which is an important distinction, are, 1.

dine water gives a brown precipitate (in ammonia there is no precipitate, ie colour is discharged). 5. Tannic acid gives a whitish yellow precipitate n ammonia there is no precipitate, but a red colour is imparted). 6. hloriodide of potassium and mercury copiously precipitates it, even hen much diluted. 7. Gallic acid gives no precipitate (in ammonia it roduces a pinkish red colour, rapidly changing to an olive green). 8. ılphuric acid and bichromate of potash produce with it a green colour by ie liberation of oxide of chromium. (See 'Guy's Hospital Reports,' Oct. 358, p. 354.)

Organic Mixtures.—To separate nicotina from the contents of a stomach, ese should be digested in cold distilled water, acidulated with sulphuric id in the proportion of a drop to an ounce. This liquid is strained, filtered, ıd the residue pressed. It is then to be evaporated to one half in a water th—digested with its bulk of cold alcohol, filtered, and the alcoholic liquid aporated in a water bath. The sulphate of nicotina is now dissolved out of ie residue by a small quantity of water and the solution is rendered alkaline by tash and then shaken in a tube with its bulk of ether; the ethereal liquid is lowed to evaporate in a series of watch-glasses, and if nicotina be present e alkaloid will be left in small oily-looking globules. The odour may not perceptible until the residue is heated, when its peculiar acridity will be ought out. A few drops of water should be added to the residue in each ass—it will be found to be strongly alkaline, and the different tests may en be applied. It was by this process that I discovered the poison in the dy of the gentleman whose case is above related. In reference to the bbit killed by a single drop (supra), nicotina was found in the stomach and contents: there was a trace found in half an ounce of the blood of the imal, and the poison was clearly detected after a week in the tongue and t parts of the throat of the animal, but there was no trace of nicotina in the er, heart, or lungs.

LEVANT NUT. (COCCULUS INDICUS.)

Symptoms and Effects.—This is the fruit or berry of the ANAMIRTA CCULUS (*Levant Nut*), imported from the East Indies. The berry contains m one to two per cent. of a poisonous nciple (*Picrotoxine*). The shell or husk tains no picrotoxine but a non-poisonous nciple called menispermine. The seeds, powder or decoction, give rise to nausea, niting, and griping pains, followed by por and intoxication. There are, so far I am aware, only two well-authenticated tances of this substance having proved ıl to man. Several men suffered from s poison in 1829, near Liverpool: each had a glass of rum strongly impgnated with cocculus indicus. One died that evening; the rest recovered. 'raill's Outlines,' 146.) Of the second case, the following details have been plished. A boy, æt. 12, was persuaded by his companions to swallow two iples of the composition used for poisoning fish. It contained cocculus icus. In a few minutes he perceived an unpleasant taste, with burning n in the gullet and stomach, not relieved by frequent vomiting—as well pain extending over the whole of the abdomen. In spite of treatment, a ent attack of gastro-enteritis supervened, and there was much febrile exment, followed by delirium and purging, under which the patient sank on nineteenth day after taking the poison. On inspection, the vessels of the mater were congested with dark-coloured liquid blood. There was



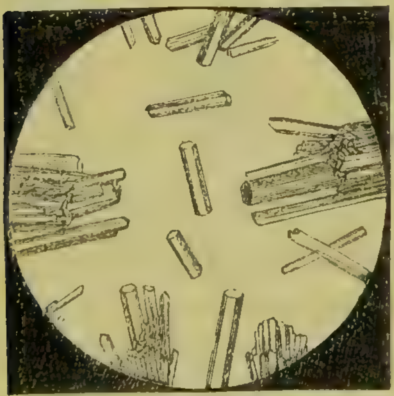
a. Berry of Cocculus Indicus, natural size.
b. The same, seen in section with one-half of the semi-lunar kernel.
c. The kernel, containing picrotoxine.

serous effusion in the ventricles of the brain, and the right lung was congested. In the abdomen there were all the marks of peritonitis in an advanced stage. The stomach was discoloured, and its coats were thinner and softer than natural. (Canstatt, 'Jahresbericht,' 1844, 5, 298.)

Porter, ale, and beer owe their intoxicating properties in some instances to a decoction, or extract of these berries. The fraud is perpetrated by a low class of publicans. They reduce the strength of the beer by water and salt, and then give to it an intoxicating property by means of this poisonous extract. A medical man consulted me some years since, in reference to the similarity of cerebral symptoms suffered by several of his patients in a district in London. It was ascertained that they were supplied with porter by retail from the same house. The effects produced by this drug are remarkable; there is a strong disposition to sleep, and at the same time wakefulness. There is a heavy lethargic stupor, with a consciousness of passing events, but a complete loss of voluntary power. It is a kind of nightmare feeling, altogether different from healthy sleep. Cocculus indicus is sometimes used by robbers to intoxicate their victims, and to this form of intoxication, the term 'hocussing' is applied. One method of detecting this poison in alcoholic liquids, consists in distilling the alcohol and testing the extract by physiological or chemical processes. The extract containing cocculus indicus is intensely bitter, and soon produces on man or an animal stupefying and narcotic symptoms. The extract of a genuine alcoholic liquid loses its narcotic properties when all the alcohol has been separated from it by distillation. For some remarks on this adulteration of beer and other liquids, and a process for separating the poisonous principle, picrotoxine, by amylic alcohol, see 'Chemical News,' March 12, 1864, p. 123.

Cocculus indicus operates readily as a poison on animals, and it has thus been frequently used for the malicious destruction of fish and game. In one instance referred to me recently, there was reason to believe that 270 young pheasants had been poisoned by grain soaked in a decoction of this substance. *Barber's poisoned wheat* for the destruction of birds owes its poisonous properties to cocculus indicus. (Horsley.)

Picrotoxine.—The poisonous principle of the berry of cocculus indicus crystallises in slender hexahedral prisms, having a silky lustre. It is soluble in 150 parts of cold water, but is more soluble in boiling water, and the solution has a very bitter taste. When heated in a tube, picrotoxine evolves an acid vapour like digitaline. Hydrochloric acid dissolves it without change of colour. It is soluble in alcohol, ether, chloroform, and in amylic alcohol. Sulphuric acid imparts to it an orange yellow colour, which becomes of a pale yellow by dilution. When bichromate of potash is added to the sulphuric acid mixture, green oxide of chronium is produced. Strong nitric acid dissolves it without any change of colour. Tannic acid and the chloriodide of potassium and mercury do not precipitate it from its solutions. When boiled with potash and the sulphate of copper it reduces the oxide like grape sugar. It is said, like salicine, to belong to the class of glucosides.

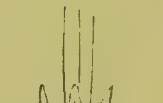


Crystals of Picrotoxine magnified 124 diameters.

Mr. Langley has shown that this principle may be separated from many of the poisonous alkaloids by taking advantage of its peculiar chemical properties. It does not combine with acids to form salts, but readily with bases. Thus water containing a small quantity of potash will dissolve one-th or one-eighth part of its weight of picrotoxine. Water thus alka- d will, it is well known, readily yield most of the alkaloids to ether, en this liquid is shaken with the solution; but if the liquid is strongly lulated, the alkaloids remain combined with the acid, while the ether ken with the liquid entirely removes the picrotoxine. Thus, in examining r supposed to be adulterated with cocculus indicus, the liquid should be lulated with hydrochloric acid, and then shaken with two volumes of ether. ethereal solution thus obtained, when spontaneously evaporated, leaves the otoxine in crystals. Mr. Langley states that by his process he has detected mall a quantity as 1-750th of a grain of picrotoxine in a pint of ale. The ach of a cat which had been poisoned was treated with alcohol and solution evaporated to dryness. Acidulated water was poured on the due, and the picrotoxine with some organic matter was dissolved. The liquid was shaken with ether, and crystals of picrotoxine were obtained he evaporation of the ethereal solution. (See 'Pharm. Journal,' December 2, p. 277.)

BEARDED DARNEL. (LOLIUM TEMULENTUM.)

ptoms and Effects.—Poisoning by darnel is generally the result of acci- from the intermixture of the seeds of this grass with wheat or rye. The s are ground into flour and eaten with the bread.


Lolium Temulentum, or Bearded Darnel.

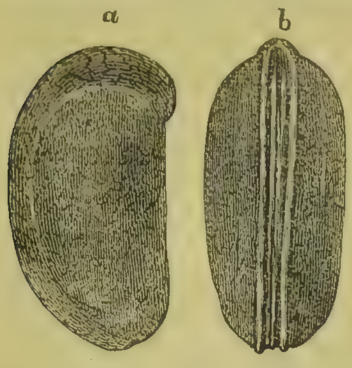
January 1854, Dr. Kingsley, of Roscrea, furnished me with particulars of some cases in which several families (including t thirty persons) suffered severely from the effects of bread aining, by accidental admixture, the flour of darnel seeds. persons who partook of this bread staggered about as if in- cated: there was giddiness, with violent tremblings of the and legs, similar to those observed in delirium tremens, of much greater intensity (the patients requesting those t them to hold them, and experiencing great comfort from assistance being given to them); greatly impaired vision, y object appearing of a green colour to the sufferer; cold- of the skin, particularly of the hands and feet; great pros- on of strength, and in several cases vomiting. Under the use of stimulants and castor oil the whole of the patients convalescent on the following day, but much debilitated the effects of the poison. Among the symptoms in other there has been noticed a sense of burning heat in the h and throat, with confusion in the head, trembling, and a irregular pulse. (See 'Ed. Monthly Jour.' Aug. 1850, 0.)

alysis.—The plant is known by its botanical characters. has lately examined darnel, in order to discover a poisonous id; but there was no trace of such a substance. By distillation with he obtained two kinds of ethereal oil, one lighter and the other heavier water; they were colourless and had the odour of fusel-oil.

ORDEAL OR CALABAR BEAN (PHYSOSTIGMA VENENOSUM).

Calabar bean is a large leguminous seed of a dark colour, resembling len bean, but much thicker and more rounded in its form. It is brought he western coast of Africa, and is there employed by the natives as an bean when persons are suspected of witchcraft. The common belief is, e innocent vomit and are safe, while the guilty retain the poison, and m its effects. So strong is popular confidence in this test, that those who spected, voluntarily take an emulsion of this dreadful seed, and, as Dr.

Christison remarks, many an innocent person thus pays the penalty of his rash reliance on this superstitious custom. As it is a firm matter of faith that if a man dies he is guilty, such a custom is beyond the reach of any appeal to reason. Illustrations of this bean of its natural size are subjoined.



a. The bean of its natural size.
b. The same seen edgewise.

This bean owes its properties to the presence of an alkaloidal substance called *Physostigmine.* It is found in the cotyledon, and the process adopted for its separation by Jobst and Hesse is described in the 'Chemical News' for March 5, 1864, p. 109.

The seed or bean has a thin hard and brittle covering; the kernel inside is white and weighs from thirty-six to fifty grains; the whole seed about sixty-seven grains. Dr. Christison could detect no poisonous alkaloid in the seed, but he found that the active principle (physostigmine) could be extracted by alcohol, which dissolves 2·7 per cent. of the seed including this substance. That alcohol will remove the poisonous principle is proved by the fact that the exhausted residue is not always poisonous. (Bouchardat, 'Ann. de Thérapeutique,' 1864, p. 73. See also 'Pharm. Jour.' 1863, p. 561.) The greater part of the seed, as in nux vomica, consists of starchy and other inert matters, with a small quantity of oil. The kernel is yellowish white, without bitterness, acrimony, aroma, or any other impression on the organ of taste. In fact it cannot be distinguished by taste from a haricot bean.

Twenty-one grains in fine powder were placed in the cellular tissue of a rabbit; for three minutes there was no change. The animal then became weak and languid; in four minutes it was unable to raise itself when placed on its side. The body then became quite flaccid and respiration ceased in five minutes. There were at intervals slight irregular twitchings in the muscles of the trunk, and a jerking of the head backwards. Two grains of the alcoholic extract produced similar symptoms. At the end of two minutes, without any previous indication, the animal suddenly became weak, fell on its side, struggled a little with its feet, and ceased to breathe in another minute. The poison, according to Dr. Christison, produces a primary impression on the heart causing paralysis of that organ, the insensibility and coma being only apparent. The results appear to show that there is also paralysis of the voluntary and respiratory muscles, but a retention of consciousness. ('Pharmaceutical Journal,' 1855, p. 473.)

Desiring to try the effects of this seed on himself, Dr. Christison took the eighth part of a seed, or six grains, one night before going to bed. There was a slight sense of numbness in the limbs during the night, but in the morning no urgent symptoms of any kind. He then chewed and swallowed the fourth part of a seed (twelve grains). In twenty minutes he was seized with giddiness, and a general feeling of torpor over the whole frame. He immediately swallowed an emetic and thus emptied his stomach. The giddiness, weakness, and faintness increased to such a degree that he was obliged to lie down in bed. In this state he was seen by two medical friends, who found him prostrate and pale, the heart and pulse extremely feeble and tumultuously irregular, the mental faculties entire, extreme faintness threatening dissolution, but no apprehension of death on the part of the patient. There was no uneasy feeling of any kind, no pains or numbness, no prickling, not even any sense of suffering from the great feebleness of the heart's action. There was the will but not the power to vomit; the limbs became chill with a vague feeling of discomfort. Stimulants were employed, and warmth and pulsation, with a

wer of moving, gradually returned. Two hours after the poison had been
ken he felt drowsy, and slept for two hours more, but with such activity of
ind, that he had no consciousness of having been asleep. The tumultuous
tion of the heart continued. After this the symptoms gradually disappeared,
d the next day he was quite well. ('Pharm. Jour.' 1855, p. 474.)

In August, 1864, fifty children were poisoned at Liverpool by reason of
eir having eaten these beans. The sweepings of a ship from the west coast
Africa had been thrown on a heap of rubbish; the children found the
eans and ate them. A boy, æt. 6, who ate six beans, died in a very short
me. The principal symptoms were severe griping pains, constant vomiting,
d contracted pupils. In addition to these symptoms the face was pale,
d the eyes were bright and protruding. In attempting to walk the children
aggered about as if they were drunk.

A drop of the extract applied to the eye of an animal produces in from ten
inutes to a quarter of an hour, a remarkable contraction of the pupil. This
s been observed to last in children for fifteen or twenty hours. (Bouchardat,
Ann. de Thérapeutique,' 1864, p. 73.) In this respect, the poison is eminently
stinguished from atropia, daturia, and hyoscyamia, which cause excessive
ilatation of the pupil. Dr. Harley found in his experiments with this
bstance that it causes contraction of the pupil when taken internally, as
ell as when applied locally. It paralyzed the motor nerves, and left the
tellect and muscular irritability unimpaired. It destroyed life by paralyzing
e respiratory muscles, and although it weakened the heart's power, it neither
opped the circulation, nor arrested the heart's action. It is not, according
him, a cardiac but a respiratory poison. It is closely allied in its effects
woorara and conia, but more to the latter. It differs from both, in its
ndency to produce muscular twitchings, and in its power of causing con-
action of the pupil. Neither woorara nor conia has any effect on the iris.
Lancet,' 1863, vol. 1, 717.)

Analysis.—The effects produced by an alcoholic extract of the seed applied
an animal furnish the only means of detection. The contraction of the
upils is a good physiological test of the presence of the poison.

POISONOUS MUSHROOMS (FUNGI).

ymptoms and Effects.—The noxious species of mushrooms act sometimes as
rcotics, and on other occasions as irritants. It would appear from the reports
several cases, that when the narcotic symptoms are excited, they come on soon
ter the meal at which the mushrooms have been eaten, and that they are
iefly manifested by giddiness, dimness of sight, and debility. The person
pears as if intoxicated, and there are singular illusions of sense. Spasms and
nvulsions have been occasionally witnessed among the symptoms when the
se has proved fatal. Dr. Peddie has related three instances of poisoning by
ushrooms ('Edin. M. and S. J.,' vol. 49, 200), in which the poison acted
a pure narcotic; there was no pain in the abdomen, nor irritation in the
imentary canal. The narcotic symptoms began in half an hour with giddi-
ss and stupor: the first effect with one patient was, that every object
ppeared to him to be of a blue colour. The three patients recovered, two of
em rapidly. When the drowsiness passes off, there is generally nausea and
omiting; but sometimes vomiting and purging precede the stupor. If the
mptoms do not occur until many hours after the meal, they partake more of
e characters of irritation;—indicated by pain and swelling of the abdomen,
miting, and purging. In a recent case of poisoning by mushrooms, there
as slight vomiting about an hour and a half after the meal, but no violent
mptoms until after the lapse of ten hours. Several cases, in which the
mptoms did not appear until after the lapse of fourteen hours, are reported

in the 'Medical Gazette' (vol. 25, p. 110). In some instances the symptoms of poisoning have not commenced until thirty hours after the meal; and in these, narcotism followed the symptoms of irritation. It might be supposed that these variable effects were due to different properties in the mushrooms; but the same fungi have acted on members of the same family, in one case like irritants, and in another like narcotics. In most cases recovery takes place, especially if there is early vomiting. In the few instances which have proved fatal, there has been greater or less inflammation of the stomach and bowels, with congestion of the vessels of the brain. See 'Med. Gaz.' vol. 46, p. 307; vol. 47, p. 673; and 'Journ. de Chimie Méd.' 1853, p. 694.)

Mr. Taylor, of Emsworth, relates a fatal case of poisoning by fungi which was attended with symptoms of irritation resembling those caused by arsenic. There was no loss of consciousness or sensibility. G. F., æt. 13, fried and ate for breakfast, at 8.30 A.M. two fungi which he had found growing under a tree. He returned to his work without complaint. At 12 he had his dinner of pork and vegetables. At 1 P.M. he returned to work where he remained until 6 P.M. working the whole time without any complaint. Soon after he reached home, he complained of feeling ill, and vomited violently. Purging then followed with severe spasmodic pain in the abdomen. These symptoms continued throughout the night until 6 A.M. The bowels then ceased to act. Mr. Taylor saw him at 11.30 A.M. He was then suffering from constant pain in the bowels occasionally aggravated: there was tenderness over the abdomen generally, but especially over the course of the transverse colon, with vomiting every ten minutes—great thirst, skin warm and perspiring, pulse ninety, and great depression. At 3 A.M. on the second day he was again seen. Vomiting and purging had returned. There was great exhaustion; pulse imperceptible; the action of the heart feeble. He was lying in bed on his back with the knees drawn up. Sensibility and consciousness were perfect. He complained of great pain in the stomach; there was tenderness over the abdomen, but no swelling of the cavity. In another hour he died, *i. e.* about forty-four hours after eating the fungi, and about thirty-four after the first setting in of the symptoms. Others partook of the fungi, but in small quantity, and they did not suffer.

On inspection, the heart on the right side contained a little fluid blood. The left ventricle was contracted and empty. The lungs were healthy, and there was only cadaveric congestion. The lining membrane of the stomach and small intestines was throughout injected, the blueish red appearance diminishing in intensity as it approached the cæcum. There were a few ecchymosed patches near the pyloric end of the stomach. The organ contained six ounces of a brownish liquid resembling thin gruel. The large intestines were empty and pale, and the spleen was congested; the other organs were healthy. ('Med. Times and Gaz.' Nov. 21, 1863, p. 536). In many of its features, and in the absence of narcotic symptoms, this case resembled a case of acute poisoning by arsenic. The fact that nearly ten hours elapsed before the symptoms of irritation commenced, and that there was no blood in the matters discharged by vomiting and purging, were the most marked differences.

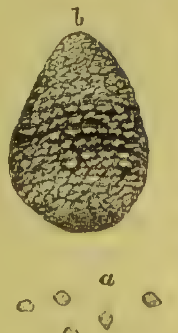
Analysis.—The discovery of portions of the mushrooms undigested in the matter vomited, or the description of the food eaten, will commonly lead to a recognition of this form of poisoning. The poisonous principle contained in mushrooms is called *Fungin*; it appears to be of a volatile nature and soluble in hot water; for some varieties of noxious mushrooms may be eaten with impunity, when they have been well boiled in water and afterwards pressed. One of the most poisonous in this country, *Amanita muscaria* or Fly-mushroom, renders the water in which it is boiled so poisonous, that imals are killed by it, while the boiled fungus itself has no effect upon m. The liquid procured from it is used as a fly-poison, whence the name of e mushroom is derived. It is an autumnal fungus known by its rich orange- l colour.

HENBANE. (HYOSCYAMUS NIGER.)

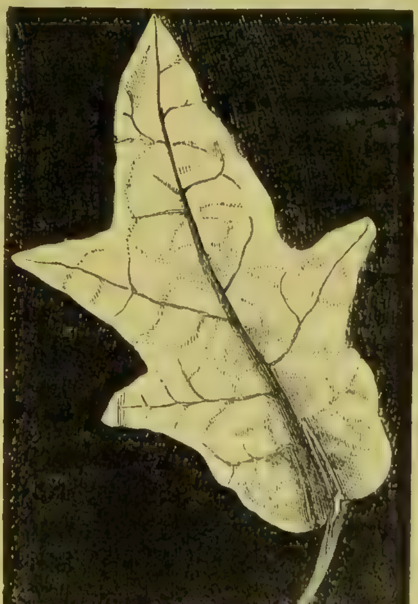
Symptoms and Appearances—The seeds, roots, and leaves of this plant are isonous. When the dose is not sufficient to destroy life, the symptoms —general excitement, fulness of the pulse, flushing of the face, weight in the ad, giddiness, loss of power and tremulous motion of the limbs, somnolency, tation of the pupils, double vision, nausea, and vomiting. After a time se symptoms pass off, leaving the patient merely languid. When a large antity of the *root* or *leaves* has been eaten, an accident which has urred from the plant having been mistaken for other vegetables, more ious effects are manifested. In addition to the above symptoms in an ravated form, there will be loss or incoherency of speech, delirium, con- ion of thought, insensibility, coma, and, sometimes, a state resembling anity; the pupils are dilated and insensible to light, there is coldness of surface, cold perspiration, loss of power in the legs, alternating with nic rigidity and convulsive movements of the muscles, the pulse small, quent, and irregular, the respiration deep and laborious. (See 'Med. z.' vol. 47, p. 640.) Occasionally there is nausea with vomiting and ging. Death may take place in a few hours or days, according to the erity of the symptoms. The special effect of this poisonous plant is nifested in its tendency to produce a general paralysis of the nervous em.

ne fatal case of poisoning by the roots of henbane is quoted by Orfila, and ther by the leaves is reported by Wibmer (op. cit. p. 147.) The appear- es consisted in a general congestion of dark-coloured liquid blood in the ous system. The lungs and brain especially manifested this condition. re are commonly no marks of irritation or inflammation in the stomach bowels.

nalysis.—When the vegetable has been eaten, an be identified only by its botanical charac- . The seeds are very small and hard; they furrowed on the surface, and may be easily ounded with those of belladonna. They are of oblong, oval or pyriform e. We subjoin illustra- s, in which they are repre- ed magnified (*b*) and of their ral size (*a*). The leaves are liar in shape and other cha- rs, by which they may be y identified. The annexed tration is from a photograph fresh leaf of henbane. The onous properties of henbane known to be owing to the ence of a crystalline alka- l body, which is called *Hy-* *mia*. It is very difficult of action. The crystals have a silky lustre,—they are not very soluble in r, but are easily dissolved by alcohol and ether. It has an alkaline reac- and its saline solutions are precipitated by tannic acid. It has an acrid



Seeds of Henbane.
a. Natural size.
b. Magnified 30 diameters.



Small leaf of Henbane of its natural size.

disagreeable taste, resembling that of tobacco. It is highly poisonous, and causes dilatation of the pupils.

LACTUCARIUM. (LACTUCA.)

Symptoms and Effects.—The two species of lettuce, known under the names of LACTUCA SATIVA and VIROSA, contain a principle which is possessed of feebly narcotic properties. Orfila has found that the extract prepared by evaporation at a low temperature, acts upon the brain and nervous system of animals; although very large doses were required for the production of narcotic effects. There is no record of these plants having exerted a poisonous action in the human subject. The inspissated juice of the lettuce is well known under the name of *lactucarium* or *lettuce-opium*. The juice, when it first escapes, is of a milky-white hue, but, in drying, it forms an extract in small irregular dry masses of a brown colour, a bitter taste, and with an odour similar to that of opium. It has a weak narcotic action when given in doses of from five to twenty grains. It varies much in strength. Wibmer found that *two grains* caused headache and somnolency. (Op. cit. 200.) It is bitter to the taste, which appears to be owing to the presence of a bitter principle called *lactucin*, upon which its feebly narcotic properties probably depend. There are no tests for lactucarium, further than the colour, the opiate odour with the want of solubility, and the absence of the other chemical characters of opium.

NIGHTSHADE. (SOLANUM.)

Symptoms and Effects.—There are two species of this plant—the *Solanum Dulcamara*, *Bitter-sweet* or *Woody-nightshade*, which has a purple flower and bears red berries; and the *Solanum Nigrum*, or *Garden-nightshade*, with a white flower and black berries. The active principle *Solania*, on which the poisonous properties of both species depend, varies in proportion at different seasons of the year. In one instance a decoction of the plant is said to have produced in a man dimness of sight, giddiness, and trembling of the limbs,—symptoms which soon disappeared under slight treatment. (For a case of poisoning by the decoction, see 'Med. Gaz.,' vol. 46, p. 548.)

The berries of the Solanum nigrum, in one instance at least, produced serious effects in three children who had eaten them. They complained of headache, giddiness, sickness, colic, and tenesmus. There was copious vomiting of a greenish-coloured matter, with thirst, dilated pupils, stertorous breathing, convulsions, and tetanic stiffness of the limbs. One child died in the acute stage: the others died apparently from secondary consequences during treatment. (Orfila, op. cit. 4ème ed. 2, 273.) From three to four berries of this plant have been found to produce sleep. In September, 1853, the red berries of the *Woody-nightshade* are stated to have caused the death of a boy, æt. 4, under the following circumstances. He had eaten some of the berries, and at first did not appear to suffer from them; but eleven hours afterwards he was attacked with vomiting, purging, and convulsions, which continued throughout the day; the child being insensible in the intervals. He died convulsed in about twenty-four hours. The vomited matters were of a dark greenish colour and of a bilious character. Other children had partaken of the berries at the same time: but among these, one only suffered slightly. ('Lancet,' June 28, 1856, p. 715.)

(SPINAL POISONS.)

CHAPTER 28.

NUX VOMICA—STRYCHNIA—SYMPTOMS AND APPEARANCES—TIME OF OCCURRENCE OF SYMPTOMS—FATAL DOSE—PERIOD OF DEATH—CHEMICAL AND MICROSCOPICAL ANALYSIS OF NUX VOMICA AND STRYCHNIA—TESTS—PROCESS FOR ORGANIC MIXTURES—DETECTION OF STRYCHNIA IN THE TISSUES—BRUCIA.

NUX VOMICA. STRYCHNIA.

NUX VOMICA in powder has a bitter taste, and cannot therefore be easily administered in a poisonous dose without exciting suspicion. It owes its poisonous properties to the presence of from one to one-half per cent. of the alkaloid *strychnia* associated with another alkaloid named *brucia*. Strychnia tself has a very bitter taste even in very small quantity: but as it destroys ife in a small dose, and it may be given in the form of pills or professedly administered as quinine or other medicines, it offers every facility for criminal administration.

Symptoms.—At a variable interval after taking either nux vomica or strychnia in a poisonous dose, the patient experiences a sense of uneasiness and restlessness, accompanied by a feeling of impending suffocation. There s a shuddering or a trembling of the whole frame, with twitchings and jerkings of the head and limbs. Tetanic convulsions then commence suddenly with great violence, and nearly all the muscles of the body are simultaneously affected. The limbs are stretched out involuntarily, the hands are clenched: he head after some convulsive jerkings is bent backwards, and the whole of he body becomes as stiff as a board. As the convulsions increase in frequency and severity, the body assumes a bow-like form (opisthotonos), being arched n the back and resting on the head and heels. The head is firmly bent backwards, and the soles of the feet are incurvated or arched and everted, the legs sometimes separated. The abdomen is hard and tense, and he chest spasmodically fixed, so that respiration appears to be arrested. The face assumes a dusky, livid or congested appearance, with a drawn, wild or anxious aspect, the eyeballs are prominent and staring, and the lips are livid. The intellect is clear, and the sufferings, during this violent spasm of the voluntary muscles, are severe. The patient in vain seeks for relief n gasping for air and in requiring to be turned over, moved or held. The muscles of the lower jaw, which are the first to be affected in tetanus from disease, are generally the last to be affected by this poison. The jaw is not always fixed during a paroxysm. The patient can frequently speak and swallow, and great thirst has been observed among the symptoms. In some cases of poisoning by nux vomica, the jaw has been fixed by muscular spasm; but, unlike the lock jaw of disease, this has come on suddenly in full intensity with tetanic spasms in other muscles, and there have been intermissions which are not witnessed in the tetanus of disease. The sudden and universal convulsion affecting the voluntary muscles has sometimes been so violent that the patient has been jerked off the bed. After an interval of half a minute to one or two minutes, the convulsions subside, there is an intermission, the patient feels exhausted and is sometimes bathed in perspiration. It has been noticed in some of these cases that the pupils during the paroxysm are dilated, while in the intermission they are contracted. The pulse during the spasms is so quick that it can scarcely be counted. Slight causes, such as an attempt to move, a sudden noise, or gently touching the patient, will frequently bring on a recurrence of the convulsions. In cases likely to prove fatal, they rapidly succeed each other and increase in severity and duration until at length the patient dies utterly exhausted. The tetanic symptoms produced by strychnia, when once clearly established, progress rapidly either to death or recovery. The patient is conscious, and the mind is commonly clear to the last. He has a strong apprehension of death. The duration of the case, when the symptoms have set in, is reckoned by minutes, while in the tetanus of disease, when fatal, it is reckoned by hours, days, and even weeks. As a general statement of the course of these cases of poisoning,—within two hours from the commencement of the symptoms, the person either dies or recovers, according to the severity of the paroxysms and the strength of his constitution. Death sometimes takes place in a paroxysm. (See case by Mr. Lawrence, 'Lancet,' June 1861, p. 572).

The *time at which the symptoms commence* appears from the recorded cases to be subject to great variation. In poisoning by nux vomica the symptoms are generally more slow in appearing, than in poisoning by strychnia. Until they set in suddenly, the patient is capable of walking, talking, and going through his or her usual occupations. In a case which occurred to M. Pellarin, a man swallowed about 300 grains of nux vomica and no symptoms appeared for two hours. He died speedily in a violent convulsive fit. ('Ann. d'Hyg.' 1861, vol. 2, p. 431.) On an average in poisoning by strychnia the symptoms appear in from five to twenty minutes. In one case convulsions came on in five minutes ('Ann. d'Hyg.' 1861, vol. 1, p. 133). In two cases at least, an hour has elapsed. ('Lancet,' August 31, 1850. 'On Poisoning by Strychnia,' 1856, p. 139.) In a case which occurred to Drs. Lawrie and Cowan in June 1853, an hour and a half elapsed. In 1848, Dr. Anderson met with an instance in which *two hours and a half* elapsed before the appearance of symptoms. ('Poisoning by Strychnia,' p. 42.) The longest interval recorded was in the following case:—A boy, æt. 12, swallowed a pill containing three grains of strychnia. No symptoms appeared for *three hours*; they then set in, in the usual way, and death took place in ten minutes. It was clearly proved that the pills taken had been composed of three grains of strychnia with mucilage: they had been prepared eight months previously for the purpose of poisoning dogs; hence they were hard, and underwent only slow solution in the body ('Lancet,' 1861, vol. 2, p. 480).

The form in which the poison is administered or applied has a considerable influence on the time at which the symptoms commence. Thus when strychnia is given in pills, especially if, as in the above case, they are hard, the symptoms are much longer in appearing than when the poison is taken in solution. Mr. Savory gave to a dog two bread pills, each containing one quarter of a grain of strychnia. No symptoms of poisoning had occurred at the end of *two hours*, but the animal was found dead a short time afterwards. When strychnia was given in solution the symptoms soon appeared, and death took place rapidly. ('Lancet,' 1863, vol. 1, pp. 515, 548.)

It is remarkable that so simple a fact connected with the absorption of this poison, should have been wholly ignored by some of the experts who appeared for the defence of William Palmer (*Reg.* v. *Palmer*, C. C. C., 1856). Palmer gave to the deceased, Cook, two pills containing strychnia. No symptoms were observed for an hour and a quarter. More than one expert swore strongly that this interval rendered it impossible that the symptoms could have been caused by strychnia! It was fortunate for the ends of justice that the jury put no confidence in strong statements thus made without any reasonable amount of experience to warrant them. The above-mentioned cases will show the great danger of trusting to such dogmatic opinions.

If the poison is applied to the cellular membrane, to an ulcerated or diseased rface, or even a healthy mucous surface, absorption takes place rapidly, and e interval for the production of symptoms is proportionably short. Dr. chuler relates a case of amaurosis in which about the 1-12th part of a grain f strychnia was introduced into the punctum lachrymale at the corner of e eye. Three or four minutes had not elapsed when symptoms of poisoning ppeared. There was convulsive respiration, with violent tetanic shocks, and e patient appeared about to die: however, the symptoms passed off, and he covered. ('Med. Times and Gazette,' July 1861.)

Appearances after Death. Externally.—In general the body is relaxed at e time of death, and stiffens afterwards: but the commencement and dura- on of the rigid state depend on various conditions. In the case of Mrs. Vyse's vo children (*Reg.* v. *Vyse* C.C.C., 1862), who died in less than an hour from e effects of Battle's Vermin Killer, administered by the mother, Mr. Savory ade the following observation:—He saw the bodies soon after death. They ere much discoloured, livid, and although quite warm, were perfectly rigid. he younger, aged five years, was rigid all over: the elder principally about e jaws and neighbouring parts. The rigidity gradually disappeared, and ter twenty-four hours there was scarcely any remaining in the elder child. ecomposition had commenced, the front of the abdomen presenting a green scolouration. The body of a person poisoned by strychnia may therefore be und in a non-rigid state within the ordinary period after death; but in most cent cases it is not unusual to find the hands clenched and the feet arched or rned inwards. In the case of *Cook*, the rigidity of the limbs, including e hands and feet, is reported to have been well marked when the body was sinterred about two months after burial.

In other instances of undoubted strychnia-poisoning no particular degree of gidity has been found at any period after death. In rabbits poisoned by nilar doses of strychnia, I have observed the body of one to remain perfectly gid for a week, while another had lost all rigidity and had begun to putrefy ter thirty-six hours. The circumstances which affect the commencement and ration of this condition of the dead body, have been elsewhere explained (see ge 17). The experiments of Brown Séquard have conclusively shown that is not any special influence of the poison on the muscles, but the mode in which operates on the system, that determines the commencement and duration of gidity in the dead body.

In the accurately observed case recorded by the late Professor Casper, of rlin (see page 334), the body was examined forty-one hours after death. It esented the slight greenish tinge of incipient putrefaction in the loins: there s slight humidity; the expression of the face was that of one quietly sleep- g—the eyes were closed, the pupils neither contracted nor dilated. Rigidity s present in its usual degree for the time of observation—well marked as it vays is in the masseter muscles by which the jaws were firmly closed, and re strongly marked in the limbs which were lying parallel with the trunk. e feet were not incurvated: the fingers as in other dead bodies were half xed inwards, and the nails were blue. There was no evidence of tetanic, l less of opisthotonic stiffness or rigidity of the body. In short, this body s externally precisely like a thousand other bodies ('äusserlich genau wie send andre Leichen') which had come before him; and any physician not rmed of the mode of death, would have had no suspicion whatever of death strychnia from the external appearances. (See report of this remarkable e revised by Casper within a few hours of his own death, in Horn's 'Viertel- rschrift der gerichtliche Medicin,' Juli 1864, p. 7.) A man who clears away error in medical jurisprudence, does as much service to science as he who covers a new truth.

mong the *internal* appearances which have been met with in different cases, are congestion of the membranes and substance of the brain, as also of the upper part of the spinal marrow, with congestion of the lungs. The heart is contracted and empty; but its right cavities in some instances have been distended with liquid blood. The blood has been found black and liquid throughout the body. The mucous membrane of the stomach has occasionally presented slight patches of ecchymosed congestion, probably depending on extraneous causes; such as the process of digestion—the presence of food—or alcoholic liquids. In most instances the stomach and intestines have been found quite healthy, and it is not in the nature of this poison either to inflame or irritate the mucous membrane. Of the appearances observed in poisoning by strychnia, there are none which can be considered strictly characteristic. Congestion of the membranes of the brain and spinal marrow is probably the most common. In a case which occurred to Mr. Startin, a man who had taken strychnia medicinally, died in less than three hours from a dose of a grain and a half. On inspection, there were extensive patches of extravasated blood beneath the arachnoid membrane of the lower half of the spinal cord. ('Med. Times and Gazette,' March 21, 1857, p. 297.) With regard to the state of the heart and lungs, their condition as to fulness or emptiness must depend rather on the mode of dying, than on the actual cause producing death.

The late Professor Casper of Berlin, who had the largest medico-legal practice in Germany, states that out of nearly 1200 medico legal inspections made by him up to December 10, 1863, no case of death from strychnia had come before him. At that date he made a careful examination of the body of a man, who had destroyed himself with strychnia, with a view, if possible, of fixing the special appearances produced by this poison, and of isolating them from those casual conditions of the body, which have been wrongly described as characteristic of the effects of strychnia. On December 10, 1863, a healthy man æt. 30 swallowed at 5 o'clock P.M. from five to six grains of strychnia. For about an hour, he lay in his room quiet. At this time, spasms commenced, and in his attempt to reach a window, he fell and lost all power of moving his legs. He was not seen for another hour, when he was found on the floor, asking for water. In attempting to raise himself, he was seized with tetanic convulsions affecting the whole of his muscles: he had three of these fits in a severe form, and died in the last at 8.15 P.M. During the spasms, as well as in the intervals, there was complete consciousness.

The external appearances in this case have been already described (p. 333). The two outer membranes of the brain were filled with blood: which throughout the body was generally fluid as in death from asphyxia—it was of a light reddish colour, as in poisoning by carbonic oxide, or prussic acid. The brain and spinal marrow were healthy. The muscles of the throat and gullet were of a dark violet colour, unlike the other muscles of the body. The lungs were natural—not congested. The right cavities of the heart were collapsed and empty, and the left cavities contained but little blood. The large vessels were also nearly empty. The spleen was congested. The stomach was half full of a mass of partly digested food: the mucous membrane was pale, firm, not softened,and when minutely examined by a lens, was found to be perfectly natural. The mucous membrane of the whole of the intestinal canal was in the same healthy state. The kidneys were healthy and not congested. The spinal marrow was especially examined throughout its whole extent, as well as the roots of the spinal nerves. It was cut into in various directions: and in no part did it present any appearance deviating from the healthy condition. So far as appearances went, there was no visible cause of death in the case of an adult, healthy man, dying in less than four hours from a large dose of this powerful poison, and obviously from its immediate effects. In this respect, strychnia

:embles other alkaloidal poisons (Horn's 'Vierteljahrschrift,' Juli 1864, 28.)

Casper considers the peculiar colour of the muscles of the throat and gullet, worthy of notice. This was the only deviation from the ordinary appear- ces which he had been accustomed to meet with in cases of violent death. he had had no previous experience of the condition of the body in death from ychnia, he had had, during a long and active life, unsurpassed opportunities observing the appearances in all other kinds of violent death. He was thus a better condition than others, to fix upon any that were really charac- istic of poisoning by strychnia. Although the examination of a dead body thus proved to throw but little light upon the question of death from ychnia, still a medical jurist has in the symptoms, their mode of occur- ice and progress, sufficient data for a safe opinion.

Quantity required to destroy Life.—The *sixteenth part of a grain* of strychnia led a child between two and three years of age in four hours. In a case by . Danvin, three-quarters of a grain killed a child, æt. 7½, in half an hour. Annales d'Hygiène,' 1861, p. 133.) In two cases of adults, in each of which uarter of a grain had been taken by mistake, the patients recovered only der early treatment. ('Lancet,' July 26, 1856, pp. 107, 117.) The smallest al dose in an adult was in the case of *Dr. Warner*. *Half a grain* of the phate of strychnia here destroyed life. ('On Poisoning by Strychnia,' pp. 8, 139.) So powerful are the effects of this drug in certain cases, that ordi- ry medicinal doses can scarcely be borne. A gentleman took one-twentieth a grain of strychnia in six doses during a period of two or three days. Severe of tetanus occurred, although half a grain had not been taken altogether. is probable in such cases that elimination is either arrested or imperfectly formed. In May 1859, Dr. Tweedie informed me of a case in which he l prescribed for a gentleman, pills, each containing 1-15th grain of strychnia. took altogether five of them, or ⅓rd of a grain at proper intervals. The ient was seized with the most alarming tetanic convulsions continuing for ne time. There was also opisthotonos of a severe kind. He only slowly overed. A *fatal dose* of strychnia for an adult may be assigned at from f a grain to two grains.

As in other cases of poisoning, many recoveries have taken place, even after ge doses of strychnia have been taken. There are at least three instances record in which persons have recovered after taking one grain. A case of overy from two to three grains is reported in the 'Lancet' for 1861, vol. 2, 169.) In the same journal, for 1863, vol. 1, p. 54, Dr. Angell describes a e in which a girl recovered in six or seven hours from a dose of *four grains* strychnia. When first seen, she was sensible, and while talking was sud- ly seized with the usual tetanic symptoms—opisthotonos, concave contrac- of the hands and feet, the muscles rigid, the eyes natural, the pulsations the heart considerably increased, the respiration difficult, and great fear of th. She had only three paroxysms, and to this probably her recovery was , as her system was not exhausted by severe and frequent convulsive at- ks. There is one instance reported in which a person is said to have re- ered from a dose of seven grains of strychnia ('Med. Gaz.,' vol. 41, p. 305). reference to this alleged recovery from large doses, it may be a question ether the strychnia was not mixed with some other substance, whereby its sonous properties were weakened. Instances of recovery from doses above or two grains must be regarded as exceptional.

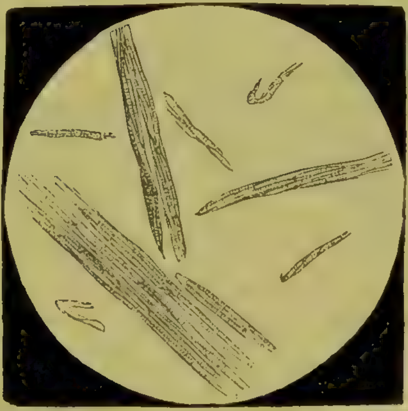
With respect to *nux vomica*, three grains of the alcoholic extract have de- oyed life. The smallest fatal dose of the powder was in a case reported by ffmann, and quoted by Christison (p. 901), also by Trail ('Outlines,' p. 137). *rty grains* of the powder, given in two doses of fifteen grains each, proved fatal. The poison was given by mistake for bark to a patient labouring under quartan fever. This is about equivalent to the weight of one full-sized seed, and to only one-third of a grain of strychnia in two doses. The dose of nux vomica required to destroy life became of some importance in *Reg.* v. *Wren* (Winchester Spring Assizes, 1851). The prisoner was convicted of an attempt to administer this poison in milk; the quantity separated from the milk amounted to forty-seven grains, which was above a fatal dose. The intense bitterness which the nux vomica gave to the milk led to detection, and this would, in general, be a bar to the criminal administration of the poison, except in the form of extract in pills.

Period at which Death takes place.—In fatal cases death generally takes place within two hours after the taking of the strychnia. One of the most rapidly fatal cases recorded is that of *Dr. Warner*. The symptoms commenced in five minutes, and he was dead in *twenty minutes*. In the case of *Cook*, the symptoms commenced in an hour and a quarter, and he died in *twenty minutes*. One of the longest cases for duration was communicated to me by Mr. Wilkins. The deceased, an adult, died in *six hours* from a dose of three grains of strychnia. ('Guy's Hosp. Reports,' Oct. 1857, p. 483.) In poisoning by *nux vomica*, death usually occurs within two hours; but Dr. Christison mentions a case in which a man died in *fifteen minutes* after taking a dose (p. 898). This is probably the shortest period known. There are several instances of recovery on record, even after large doses. Mr. Iliff has reported a case in which a female recovered after taking two drachms of nux vomica. ('Lancet,' Dec. 15, 1849.)

Vermin and Insect Killers.—Although it is difficult to procure strychnia at a druggist's shop, it is extensively sold to the public by grocers, oilmen, and others, under the name of Vermin Killers, in threepenny and sixpenny packets. *Butler's Vermin-Killer* consists of a mixture of flour, soot, and strychnia. I have found the sixpenny packet to weigh about a drachm, and to contain from two to three grains of strychnia. As the poison is mechanically mixed with the other ingredients, and is probably manufactured on a large scale, the proportion of strychnia is liable to variation. By the aid of a lens, the poison may be seen scattered in white particles through the coloured powder. The threepenny packet contains about half the quantity of strychnia, but, as it will be seen, quite sufficient to destroy the life of an adult. In place of soot, Prussian blue is sometimes used as a colouring substance. *Battle's Vermin Killer* is a powder similar to that of Butler, containing a fatal proportion of strychnia, as it is sold in packets. These powders are a fertile source of poisoning either through accident or design: they are openly sold by ignorant people to others still more ignorant. In *Reg.* v. *Vamplew* (Lincoln Autumn Assizes, 1862), it was proved that the prisoner, a girl under 13 years of age (!), had purchased one of these powders at a village shop and had destroyed her master's infant with it. There was also reason to believe that this girl had destroyed two infants by similar poisons in two other families where she had acted as nurse. They had all died suddenly in fits! In the above case, I examined a similar powder purchased for threepence at the same shop, and found it to consist of about thirteen grains of flour, coloured with Prussian blue and mixed with three-quarters of a grain of strychnia. Another Battle's powder, purchased in London for threepence, weighed like this about thirteen grains, and a sixpenny packet weighed twenty-three grains. The poison is therefore in a more concentrated form than in Butler's powder. A case in which a young woman was killed in two hours by a threepenny packet of this powder was communicated to me in July, 1864: and another in which a drachm-packet of Butler's killer destroyed a girl, æt. 17, in one hour, has been reported by Mr. Saville ('Med. Times and Gaz.,' Nov., 1857). It would be easy to add to these many other fatal cases which have fallen within my own knowledge; but they present nothing out of the usual course. The persons have all died under the ordinary symptoms of poisoning by strychnia, in a well-marked form. The appearances in the body are similar to those seen in death from strychnia: but there is one caution to be given in reference to the examination of the stomach. As death is commonly rapid and there is no vomiting, the colouring matter, either soot or Prussian blue, should always be sought for in the stomach. Strychnia may or may not be found, according to the amount swallowed and the degree to which absorption has gone on during life. Some cases of recovery are reported. In 1859 a man recovered after taking a whole packet containing nearly three grains of strychnia ('Ed. Monthly Journal,' 1859, vol. 2, p. 507); and in 1860, Dr. Part met with an instance of recovery in which a girl took half a packet. In these cases the favourable results were probably due to vomiting excited by emetics.

Chemical Analysis.—*Nux vomica* is well known as a flat round kernel, about the size of a shilling, with radiating silken fibres, slightly raised in the centre. It is of a light brown colour, and covered with a fine silky down. It is very hard, brittle, tough, and difficult to pulverize. The powder is of a grey brown colour, like that of liquorice: it is sometimes met with in a coarsely rasped state: it has an intensely bitter taste. It yields to water and alcohol, strychnia, brucia, igasuric or strychnic acid, and some common vegetable principles. Heated on platinum foil, it burns with a yellow smoky flame. Nitric acid turns it of a dark orange-red colour, which is destroyed by chloride of tin. These properties are sufficient to distinguish it from various medicinal powders which it resembles. In one case of poisoning by this substance (*Reg.* v. *Wren*) I found a quantity of guaiacum powder mixed with the nux vomica. This so completely changed the action of nitric acid, as in the first instance to create some difficulty in identifying the substance. The analyst must be prepared for these admixtures or adulterations.

Seeds of Nux Vomica, natural size.

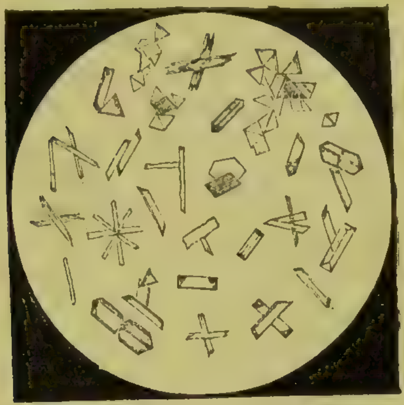


Hairs of Nux Vomica, magnified 124 diameters.

The aqueous *infusion* or *decoction* is reddened by nitric acid, and is freely precipitated by tincture of galls. Persulphate of iron gives with it an olive-green tint. The fine silky fibres or hairs which cover the surface of the seed may be obtained by washing the residue of the powder in the stomach, or the sediment of any liquid with which the nux vomica may have been mixed. As in other poisonous seeds or roots, the strychnia is slowly removed from the powder by the absorbent vessels of the stomach, and carried into the blood, until that liquid is sufficiently impregnated with the poison to produce sympoms. The powder itself remains, as it is unalterable by the fluids of the stomach. Strychnia may be extracted from nux vomica by a simple process, which is described at p. 345.

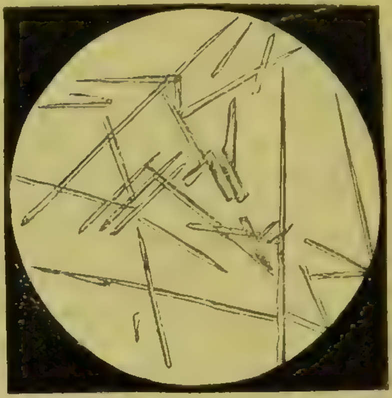
Strychnia.—This alkaloid may be readily obtained crystallized from an alcoholic solution. The crystal is very small, and its form is subject to great variation, according to the strength of the solution, rapidity or slowness of evaporation, the presence of foreign matters, &c. It is commonly seen in octahedra, sometimes lengthened into prisms of a peculiar shape, bevelled at the ends, and crossing each other at angles of 60°. (See Fig. 1.) There are as many as six or eight varieties of crystals, so that too much importance must not be attached to this branch of the analysis. As strychnia is procured from the solutions of its salts by the addition of ammonia, it is usually deposited in long slender prisms. (Fig. 2.)

FIG. 1.



Various forms of Crystals of Strychnia, as they were obtained from an alcoholic solution. Magnified 124 diameters.

FIG. 2.



Crystals of Strychnia obtained by adding ammonia to the sulphate. Magnified 124 diameters.

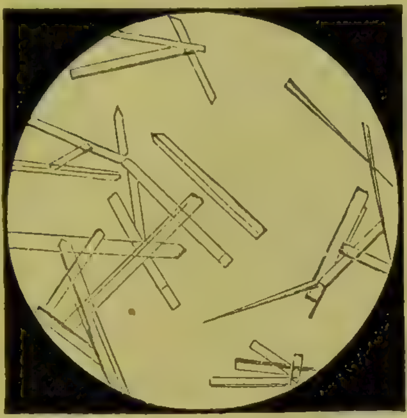
1. Strychnia is white, of an intensely bitter taste, even when it forms only 1-30,000th part of a solution. 2. When heated on platinum, it melts and burns like a resin, with a black smoky flame; in a close tube it yields ammonia. 3. It is not perceptibly dissolved by cold water: it requires 7,000 parts for its solution. 4. It is easily dissolved by acids, and is precipitated from the concentrated solutions by potash, in which it is insoluble. 5. Strong nitric acid imparts to it a reddish colour, owing to the presence of brucia. 6. Sulphuric acid produces no apparent change in it: but when to the mixture a small crystal of bichromate of potash, of ferricyanide of potassium, or a small quantity of black oxide of manganese or of peroxide of lead is added, a series of beautiful blue, purple, and violet colours appear, which pass rapidly to a light flesh-red tint. Among these substances black oxide of manganese will be found preferable. By reason of its insolubility, it imparts no colour to the liquid if strychnia is absent; and if the alkaloid is present it slowly brings out the colours, so that there is time to make full observation. Permanganate of potash has been recommended as a substitute for the oxide, but it is objectionable on account of its solubility, and of its being already coloured. Dr. Letheby has suggested the use of a small galvanic battery for the production of the coloured reaction. In this case sulphuric acid only is required. It presents no practical advantage over the use of manganese.

The salts of strychnia are very soluble in water, and these solutions give crystalline precipitates, with a large number of substances. The alkalies and alkaline carbonates, if diluted, precipitate the alkaloid in slender prisms (see Fig. 2). The sulphocyanide of potassium, ferricyanide of potassium, nitroprusside of sodium, and chromate of potash furnish with it well-defined prismatic crystallizations. In the latter case the crystals are stellated and of a yellow colour. Two of these groups will be found delineated in the annexed illustrations. (Figs. 3 and 4.)

Mr. Horsley has suggested that a solution of strychnia should be sufficiently concentrated, and then precipitated by chromate of potash: the crystals may be examined microscopically, and afterwards, on being touched with strong sulphuric acid, the colour reactions are at once brought out.

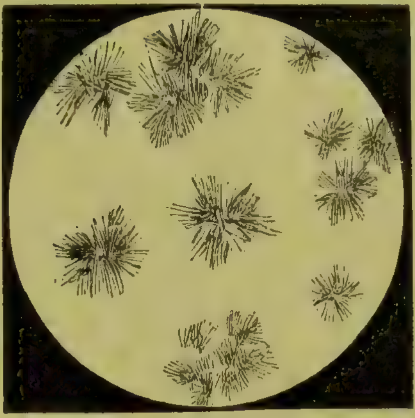
Strychnia has been fatally mistaken for santonine, salicine, and jalapine, and ıas caused death on several occasions. Jalapine does not crystallize, and the

FIG. 3.



Crystals of Sulphocyanate of Strychnia magnified 124 diameters.

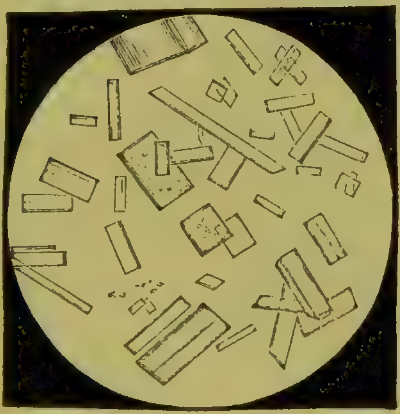
FIG. 4.



Crystals of Chromate of Strychnia magnified 24 diameters.

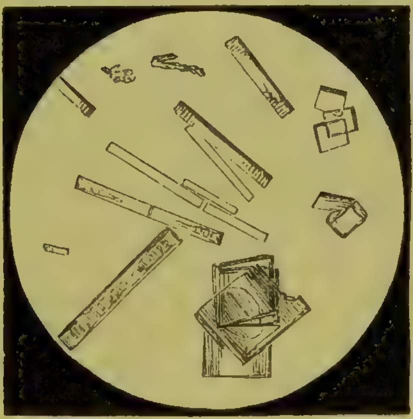
rystalline forms of santonine and salicine are, as it will be seen by the annexed llustrations, very different from those of strychnia.

FIG. 5.



Crystals of Salicine magnified 124 diameters.

FIG. 6.



Crystals of Santonine magnified 124 diameters.

These two vegetable principles differ from strychnia in their properties. Vhen heated in close tubes, they give off *acid* vapours. Salicine is soluble ı water. Santonine is not soluble in water, but is dissolved by alcohol. 'annic acid and the chloriodide of potassium and mercury do not precipitate ıe solutions, while they readily precipitate those of strychnia. Nitric acid has o effect upon either, while sulphuric acid, which does not change santonine, ives a pink red colour to salicine. The crystals of santonine closely resemble n microscopical appearance) those of salicine, but they are distinguished from ılicine and other alkaloids and principles by acquiring a brilliant yellow olour on exposure to sunlight, without undergoing any change of form.

In *Organic Mixtures*, the process originally suggested by Stas is generally referred for the separation of this poison. The principle of its operation onsists in dissolving the strychnia by a gentle heat out of the tissue or organ nely cut up, by means of rectified spirit mixed with a small quantity of acetic cid. The liquid is strained, and the residue well pressed and washed with lcohol: the acid solution of strychnia thus obtained is concentrated in a waterıth at a low temperature. The concentrated liquid is neutralized by potash, nd a slight excess of alkali is added. The alkalized liquid is then shaken in long stoppered tube, with twice its volume of ether, or a mixture consisting f two parts of ether and one of chloroform. These liquids dissolve the strychnia set free by the alkali. The ethereal solution is separated from the watery liquid by a pipette, and submitted to spontaneous evaporation, when, if strychnia is present, the alkaloid will be obtained, but generally associated with oily and other organic matters, which interfere with the production of crystals. The impure residue left by the ether is heated in a water-bath, with a few drops of strong sulphuric acid: this destroys the organic matter. Water is added, and the acid liquid is filtered through paper, neutralized by potash, and again treated with ether, when strychnia will be obtained in small and slender prisms. The crystals, after an examination by the microscope (see Fig. 2, p. 338), are treated with sulphuric acid and peroxide of manganese, and the colour reactions of strychnia, if the alkaloid is present, will appear. By this process, I have detected strychnia in the liver of a person who died from this poison, although the organ was in a highly putrescent state.

Strychnia is not separated from its salts by ether: hence this liquid may be first employed for removing such organic matters as are soluble in ether before neutralizing the liquid with potash. By this expedient, the strychnia may be obtained in a much greater state of purity in the first evaporation.

The reader will find a full account of the processes for strychnia in organic solids and liquids in some valuable papers published by Dr. Wormley, in the 'Ohio Medical Journal,' January 1864, p. 19, and March 1864, p. 119. This gentleman describes a case in which, from a misapplication of the process, strychnia was sworn to be present, when, from the chemical method pursued, the alkaloid could not possibly have been separated; and two instances have fallen within my own knowledge recently, where the colours produced by sulphuric acid and bichromate of potash, on the concentrated and dry organic contents of the stomach, were referred to strychnia, when they were really due to the decomposition of the salt employed. The detection of this poison in the stomach or the tissues, will depend on the same conditions as those observed in other cases of poisoning. If a person takes a large dose and dies quickly, a residuary portion may be readily found. In *Reg.* v. *Burke*, (Clonmel Summer Assizes, 1862), the prisoner administered strychnia to his wife in Epsom salts. She died in about half an hour under the usual symptoms. Dr. Blyth extracted more than three grains of the poison from the contents of the stomach. If a small dose has been taken, and the person has survived some hours, it is probable that none will remain in the stomach. A decomposed state of the viscera and their contents does not appear to interfere with the detection of this poison. It has been suggested that the presence of morphia counteracts the colour tests: but unless in admixture with the strychnia in large proportion, this is not probable. Besides, in Stas's process, the morphia is not dissolved by the ether.

Persons may die from strychnia, and no trace of the poison be found in the body. In a case of poisoning by this alkaloid, which was the subject of a trial for murder at Perry Co. Pa., in the April term of 1861, Dr. Reese, of Philadelphia, made separate analyses of the contents of the stomach and the contents of the intestines, as well as of the tissues, and each one of these was repeated a second time, to avoid all possible error. Yet there was no evidence of the presence of strychnia by the bitter taste of the final extract, or by the colour tests. The witness, by a comparative experiment, satisfied himself that he could detect the half-millionth of a grain. ('Amer. Jour. Med. Sci.' Oct. 1861.) In Dr. Reese's case, the quantity taken was unknown, the woman lived five or six hours, and the body was not examined until six weeks after death. A small dose and the duration of the case, will sufficiently account for the negative results, without resorting to any other hypothesis.

When death has been caused by small doses applied under the skin, it is not likely that the poison will be found in the tissues. The following experinent was performed in May, 1864. One eighth of a grain of acetate of trychnia in coarse powder was placed in the cellular membrane of the neck f a rabbit. In nine minutes the animal was seized with a sudden convulsion nd fell on its side : its fore and hind legs were rigidly stretched out, and its ody passed into a state of opisthotonos. It had a succession of fits, and died n one of them in twenty minutes after the commencement of the symptoms. ne half of the powdered acetate was still found in the wound, showing that he rabbit had been killed by the 1-16th of a grain. Of course the *residuary* trychnia was easily detected in the wound : it was plainly visible to the eye. n applying Stas's process to the heart, with the blood and the liver, the sts failed to indicate the slightest trace of the alkaloid. The ethereal liquid eft no crystalline residue of any kind. This result does not show that strychnia s not absorbed, but it proves that under certain conditions it cannot be etected in the organs of the body, in cases in which, beyond all doubt, it has estroyed life. In instances in which death has been caused by nux vomica, hich contains only one per cent. of the poisonous alkaloid, so far as I know, trychnia has not been found deposited in the tissues.

The following case, which occurred at Liverpool, in April, 1864, of which he particulars have been communicated to me by Dr. J. B. Edwards, shows he rapidity with which the poison may be diffused and deposited in the issues, when a large dose has been taken. A strong healthy man, æt. 43, laced upon his dry tongue, at 10 P.M., a powder which contained six grains f Dover's powder and *five grains* of strychnia (dispensed by mistake for five rains of James's powder). He complained of a bitter taste, asked for an range, and he found, on sucking this, that it increased the bitterness—the cid juices of the orange instantly dissolved the strychnia, and thus favoured s early absorption. In fifteen minutes he went to bed—twitchings of the uscles then came on, and the patient, from previous experience in taking rychnia as a medicine, was fully aware of the cause of the symptoms. He mplained of his bowels being drawn up; he drew his knees up as if to his outh, gave a yell, seized a friend who was standing by, and became appa- ently unconscious (exhausted) for about five minutes. He then revived, ut in a few minutes was again seized with a violent convulsion of a tetanic haracter, and he died in two or three minutes afterwards, a little over half n hour after taking the powder. Owing to a spasmodic closure of the jaws, he as able to speak only for a few minutes at a time; he was rational, but seemed be in great terror. An inspection was made thirty-six hours after death, hen the body was found to be unusually warm. The back and lower parts ere much discoloured, but the discolouration was easily removed by pres- ure, indicating a fluid state of the blood. The lower jaw was slightly drawn p, the body straight, not arched; the fingers slightly flexed, not clenched; e thumbs were fixed, but not bent into the palms of the hands. On opening e head, the scalp was found very much gorged with fluid blood. The mem- anes of the brain were also much congested, as well as the blood-vessels of e brain generally. There was no clot or coagulum, but a quantity of rous fluid escaped from the surface. There was no softening of the sub- ance of the brain or spinal cord. The lungs were healthy, but dark coloured om engorgement with blood; the heart was empty, its structure was soft; e liver was healthy, the spleen was gorged with fluid blood; the kidneys ere congested. The other organs presented no appearance calling for notice. y chemical analysis, Dr. Edwards found strychnia in the stomach, the uantity being estimated at about one grain. He also found the poison the tongue and the liver. He sent to me a portion of the liver, one dney, and six ounces of blood. They were in a putrescent state, and, when amined about three months after death, eight ounces of the liver yielded, by the process above described, prismatic crystals of strychnia, producing the usual colour-reactions with sulphuric acid, and peroxide of manganese, as well as with bichromate of potash. The quantity of strychnia thus obtained was small. The kidney and the blood did not give results on which any reliance could be placed.

This case shows that a large dose of strychnia rendered soluble will destroy life in half an hour—that in this short time, four-fifths may be removed from the stomach, or at least not be discoverable there by careful chemical analysis after death—that in half an hour the poison may be distributed through the body and deposited in the soft organs, although no satisfactory evidence of its presence could be obtained from less than half a pound of animal matter. The strychnia found in the tongue was probably a portion of the powder which still remained there. It may be further remarked that, although deceased took in the James's powder 6-10ths of a grain of opium, no morphia was present in the crystalline residue obtained from the liver. (For numerous additional facts and cases connected with this question, see 'Guy's Hospital Reports,' Oct. 1856, p. 326, and 'On Poisons,' 2nd edit. 1859, pp. 70 and 788.)

If strychnia has been administered in *pills* and, after death, the stomach has been cut open and the contents lost, there will be little hope of discovering the poison, although in *Reg.* v. *Palmer* (C. C. C., May 1856) some experts affirmed that this state of things would not materially interfere with the chemical process for its detection! The diffusion of the contents of this organ through the whole of the small and large intestines and their feculent fluids was treated as a comparatively unimportant matter, only creating delay in obtaining the results! It need hardly be observed that these are speculative opinions, and that the experts who uttered them, had never met with or seen a case by which they could be fairly tested. In those inspections in which there has been such criminal interference or culpable neglect, as in that of *J. P. Cook*, the only course for the analyst is to seek for the poison in the tissues. This case, concerning which so much has been said and written in utter ignorance of the scientific facts, settled nothing in reference to the presence or absence of strychnia in the body of a person poisoned by this substance. Except the actual removal of the stomach itself, everything had been done which possibly could be done in order to render any chemical analysis utterly fruitless. It cannot therefore be taken as a fair precedent in any sense for the results of a proper medico-legal research in poisoning by strychnia. The greatest reproach on Dr. Rees and myself would have been that we should have detected strychnia under circumstances in which any honest and unprejudiced analyst would have pronounced its detection next to impossible. It is satisfactory to find that a correct view of this remarkable case, and its true bearings on science, are now showing themselves among continental jurists. In an analysis of it, by the late Professor Casper (Horn's 'Vierteljahrschrift,' Juli 1864, p. 26), not only are the chemical results regarded as negative, by reason of the mismanagement of the inspectors, but the *post-mortem* appearances themselves, for a similar reason, are considered as throwing no light upon the effects of strychnia on the body. The active co-operation of a professional poisoner, at the examination of the body of his victim, is an exceptional circumstance, even for the liberal customs of this country. It was only the natural course of things that attempts were actually made to defeat a chemical analysis, but when such attempts have proved successful, it is not usual to find scientific witnesses actively struggling for the honour of defending a criminal, not because the deceased did not die from poison, but because it was not chemically detected in his body. Assuming that there had not been this criminal interference with the dead body on the part of *Palmer*, the position assumed—that strychnia, if a cause of death, must always, and under all circumstances, be found in the dead body, is untrue. Its detection in the body, properly verified, is a proof that it has been taken; the symptoms in their commencement, progress, and termination, furnish irrefragable proof that it has acted as a poison; but its non-detection does not prove that it has not destroyed life, or, in the words of Casper, 'Das Nichtauffinden des Giftes allein kann aber niemals einen Gegenbeweis abgehen.'

[For a more complete history of the *medical* facts in the case of *Cook*, I must refer the reader to a paper on 'Poisoning by Strychnia,' 'Guy's Hospital Reports,' October 1856. The most able legal analysis of it by any English writer which I have seen, has been published by Mr. J. F. Stephen, in his 'General View of the Criminal Law of England,' 1863, p. 357. Of the foreign reports, one by M. Tardieu, in the 'Ann. D'Hygiéne' for 1856, 2, 371, and 1857, 1, 132, and the other by Professor Casper in Horn's 'Vierteljahrschrift für ger. Medicin,' &c., 1864, 2, p. 1, are the most correct in their medical and medico-legal details.]

In the recent case examined by Casper (p. 334) the deceased admitted that he had taken between five and six grains of strychnia. He lived three hours and a half, and on analysis Dr. Sonnenschein procured from the stomach three grains of the poison. He did not, however, succeed in extracting any from he blood or tissues. (See case, loc. cit.)

It is impossible to pass from the subject of the detection of this poison without referring to cases in which it is stated that it has been found in 'traces' in the body, when there have been no symptoms of poisoning, and, so far as evidence has been produced, nothing inconsistent with death from natural causes. However confident a man may be in the results obtained by chemical tests applied to quantities of matter too small to be estimated by weight, he is venturing on highly dangerous ground if, in the absence of the usual symptoms, nd adversely to those which are in evidence, he bases an opinion of death rom strychnia upon such microscopic results. The case of a woman named Thomas (*Reg.* v. *Jane Thomas*, Pembroke Lent Assizes, 1863) is in this respect f great interest. The prisoner was charged with the murder of her illegitimate nfant by administering to it strychnia. The child had had ordinary convulsions and had died suddenly. No immediate cause of death was apparent to the medical man on an examination of the body. The chemical investigation was made by a gentleman, not a member of the medical profession, and therefore nable properly to appreciate the relative value of symptoms and appearances n throwing a light upon the cause of death. He is, however, well known as an nalyst, and no doubt acted *bonâ fide* upon a purely chemical view of the case. The following is an extract from a copy of his deposition on which the woman was committed for murder:—'On examining the stomach and intestines, I ound they were inflamed in patches—the stomach to a moderate extent, and he duodenum to a greater extent. I found on analysis that there was no metallic or mineral poison present: the nature of the inflammation induced me to examine them for strychnine, and upon treating the contents of the tomach and part of the liver by analysis, I found in them traces of strychnine. . . . Taking all the circumstances together, I have no doubt that the child died from strychnine in some form or other. I have heard the evidence of he other witnesses (Hannah Davies and Ann Thomas) read, and am more onvinced of my opinion. The rigidity might have gone off three days after death!' As this deposition bears the signature of the chemical witness, there an be no doubt that this was the evidence which he was prepared to give on he trial for murder. The deposition of Hannah Davies was to the effect, hat when she was called to the child, it had just died in the lap of Ann Thomas, the grandmother. She did not see the child move. It was a small hild and had had a convulsive fit, and turned purple three days after its birth:

it frequently vomited up the milk: it had only the milk and biscuits for its food. Ann Thomas, the grandmother, stated that she was called by her daughter, the prisoner, to the child. She took it in her lap; its breathing was short, and it died in her lap. It was not a healthy child: there was a rash about it from the time of its birth. For three days before its death it refused the breast and would suck very little. 'There were spots like bladders on its face. It *had only one fit!* The child's face had been swelling a couple of days before his death. The body was stiff immediately after the breath left the body, but I do not recollect whether the hands were closed or open. The child was lying straight across my lap when it died.' The statement of the prisoner (Jane Thomas) was as follows:—'Only mother (Ann Thomas) and I fed the child. I was the only person that nursed and dressed it from two days old. The child had the biscuit when it was a day or two old; he threw it up, and I left it off. It was fed with milk from my breast afterwards.' The chemical analysis showed that there was farinaceous food (biscuit) and milk in the stomach of deceased.

To those acquainted with the operation of strychnia on the body, it will be apparent that there is not a single circumstance in this case indicative of the action of the poison. There was only one fit—a common convulsive fit, such as that to which weak and unhealthy infants are frequently liable. The mode of death, as described by the witnesses, is not consistent with death from strychnia. The body was stiff not before but immediately after death. This infant, which was unhealthy from its birth, obviously suffered from ordinary convulsions, and died from debility and exhaustion. With regard to the inflammation (!) of the stomach and duodenum, if really present, this could have had no connection with death from strychnia, but must have depended on another cause. Further, unless all experience respecting the action of strychnia on human beings, whether infants or adults, and on young animals, is to be set aside for the sake of certain chemical colour-tests, it is quite clear that there could have been no 'traces' of this poison either in the contents of the stomach or in the liver, and that an undue confidence in chemical reactions had led to a serious error. It was a fortunate circumstance for the accused that the Grand Jury threw out the bill against her.

From this and other instances in which strychnia is stated to have been present, when all the facts, pathological and chemical, were opposed to the statement, it is impossible to avoid the conclusion that innocent persons are exposed to great peril from erroneous accusations. In no case of alleged death from strychnia would it be safe to trust to chemical evidence of 'traces,' unless these results were most strongly supported by the *symptoms* preceding death, or by experiments with the matters extracted, on the bodies of animals. The chemical witness who stated that he had detected 'traces' of strychnia in the contents of the stomach and in the liver of Jane Thomas's child, gave strong evidence for the defence in *Reg.* v. *Palmer* (1856), and professed his ability to discover the presence of strychnia in any body into which it had been introduced as a poison. He had found it in the blood and in a small part of the liver of a dog poisoned by it; and he also said he could detect the fifty-thousandth part of a grain, *if it were unmixed with organic matter.* (Case of Palmer, Stephen's 'View of Criminal Law of England,' p. 385.) He has now lived to prove that strychnia, or something resembling it, can be detected in cases in which there is no reason to believe it is present. In Thomas's case there was no evidence of the administration, or even the possession or purchase of poison; the symptoms preceding death were wholly inconsistent with strychnia-poisoning, and, at the same time, quite consistent with death from natural causes.

One other point here calls for notice, because it shows the great danger which may arise from a Criminal Court receiving medical evidence from one not trained by a medical education to observe the appearances in the dead body. The stomach and intestines of the deceased child were stated to have been *inflamed* in patches, and the *nature* of the *inflammation* induced the witness to examine the parts for strychnia. It is not the action of strychnia to produce inflammation of the stomach and bowels. No pathologist has ever seen or described this as an effect of strychnia on the body. In Casper's case (p. 334), in which a man took a dose of strychnia large enough to destroy a hundred infants, the stomach and bowels were in their natural condition! The slight patches of congestion or injection, sometimes described as being found in the stomach, are frequently the result of digestion going on at the time of death. If the mucous membrane of the stomach and duodenum was really inflamed in this case, it pointed rather to the effect of an irritant substance than of strychnia. (See Casper, loc. cit. p. 24.)

The case of Thomas, viewed in all its aspects, clearly leads to one of two conclusions: 1, either that persons may die from strychnia, and no symptoms be produced to indicate poisoning; or, 2, that chemical evidence of *traces* in a dead body may be sometimes based upon delusive results. There will be no difficulty in deciding which is the more probable, or the safer conclusion to adopt.

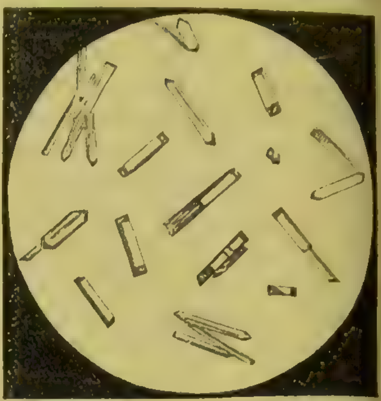
A similar case in reference to the alleged death of an infant from arsenic, in which the lives of two innocent persons, a mother and grandmother, were imperilled by an exclusive reliance on chemical evidence, was tried before the late Baron Platt. (*Reg.* v. *Dore* and *Spry*, Central Criminal Court, August 1848. See 'On Poisons,' 2nd ed., p. 226.) The learned judge, on hearing the evidence for the prosecution, indignantly directed the accused, a mother and daughter indicted for murdering the infant of the latter, to be discharged, without calling upon them for a defence. The child had died from intussusception of the bowels; and the arsenic had been administered to the infant in mistake for calomel by a medical practitioner, shortly before its death!

Strychnia in Organic Solids.—From the Vermin-killers of Butler and Battle, the strychnia may generally be readily separated by means of alcohol, and procured in a crystalline form for the application of tests. The following process I have found to be preferable for the detection of strychnia and brucia in nux vomica:—Digest the powder in a small quantity of diluted sulphuric acid by a water-bath heat. The substance should be well stirred with the diluted acid, which, after a short time, completely carbonizes it. The mass is heated to dryness, then treated with a small quantity of distilled water and filtered, by which an acid liquid of a pale sherry colour is obtained. On neutralizing this liquid with potash, and agitating it with two volumes of ether, the strychnia is separated, and may be obtained crystallized by the evaporation of the ethereal solution. Ten grains of nux vomica=to 1-10th grain of strychnia, gave satisfactory results. Prismatic crystals were procured which gave the appropriate reactions with the colour tests. Brucia was also detected by the action of nitric acid on the crystals.

In cases in which the poison is contained in pills or powders, having much organic matter soluble in alcohol, it will be advisable to employ either dilute or concentrated sulphuric acid. It is a remarkable fact that strychnia itself is not acted on in the same degree by sulphuric acid as organic matter, or even other poisonous alkaloids.

BRUCIA.

Brucia is an alkaloid generally associated with strychnia. It is contained in the seeds of nux vomica, and more abundantly in the bark of the tree. It is not so powerful a poison as strychnia, but the symptoms which it produces are similar. It is considered to have about one-sixth of the strength of strychnia. It is not affected by the colour-tests employed for the detection of strychnia, and it acquires an intense red colour on the addition of nitric acid. It is more soluble in water than strychnia, and has a bitter taste. Hydrochloric and iodic acids produce in it no change, either in the cold or when heated. Sulphuric acid gives to it a pink red colour without carbonising it. The sulphate of brucia crystallises in well-defined prisms truncated at the ends. They are larger and longer than the prisms of strychnia.



Crystals of Sulphate of Brucia, magnified 124 diameters.

(Cerebro-Spinal Poisons.)

CHAPTER 29.

CONIUM MACULATUM. HEMLOCK—CONIA—ŒNANTHE CROCATA—ÆTHUSA CYNAPIUM—ACONITE OR MONKSHOOD. ACONITINA.

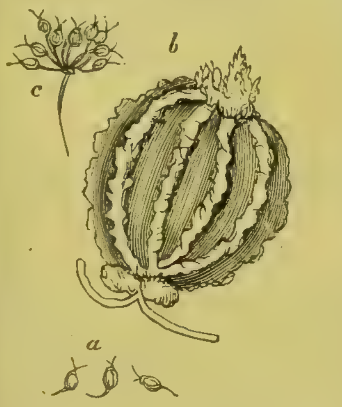
Common or Spotted Hemlock. (Conium Maculatum.)

This is a well-known hedge-plant, which grows abundantly in most parts of Great Britain. Its poisonous properties reside in the seeds, leaves, and roots.

Symptoms and Effects.—The effects produced by hemlock have not been uniform; in some instances there have been stupor, coma, and slight convulsions; while in other cases, the action of the poison has been chiefly manifested on the spinal marrow—*i.e.* it has produced paralysis of the muscular system. A man ate a large quantity of hemlock-plant, by mistake for parsley. In from fifteen to twenty minutes there was loss of power in the lower extremities: but he apparently suffered no pain. In walking, he staggered as if he was drunk; at length his limbs refused to support him, and he fell. On being raised, his legs dragged after him, and when his arms were lifted, they fell like inert masses, and remained immovable. There was perfect paralysis of the upper and lower extremities within two hours after he had taken the poison. There was loss of power of deglutition, and a partial paralysis of sensation, but no convulsions, only slight occasional motions of the left leg; the pupils were fixed. Three hours after eating the hemlock, the respiratory movements had ceased. Death took place in three hours and a quarter; it was evidently caused by gradual asphyxia from paralysis of the muscles of respiration; but the intellect was perfectly clear until shortly before death. On inspection, there was slight serous effusion beneath the arachnoid membrane. The substance of the brain was soft; on section there were numerous bloody points, but the organ was otherwise healthy. The lungs were gorged with dark fluid blood; the heart was soft and flabby. The stomach contained a green-coloured pulpy mass resembling parsley. The mucous coat was much congested, especially at its greater end. Here there were numerous extravasations of dark blood below the membrane, over a space of about the size of the hand. The intestines were healthy, here and there presenting patches of congestion in the mucous coat. The blood, throughout the body, was fluid and of a dark colour. A portion of the green vegetable pulp was identified by Dr. Christison, as part of the eaves of the *Conium maculatum.* Some of the leaves bruised in a mortar ith a solution of potash, gave out the peculiar odour of the alkaloidal rinciple, conia. ('Ed. Med. and S. J.' July 1845, 169.)

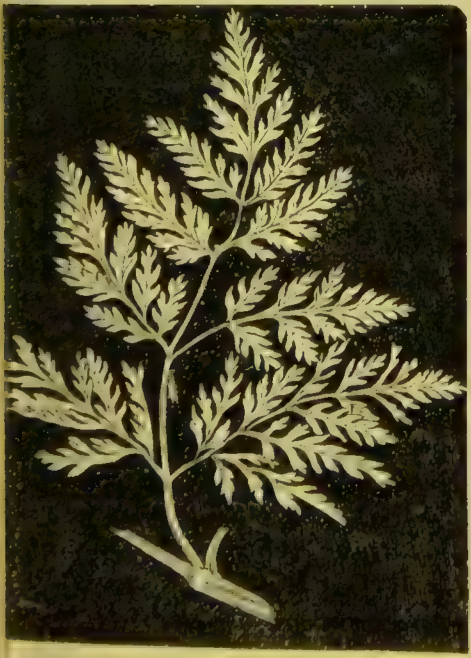
In a case which occurred to myself, which was the subject of a trial for urder (*Reg.* v *Bowyer*, Ipswich Summer Assizes, 1848), the child died in ne hour after swallowing part of a teacupful of a decoction of hemlock, lleged to have been administered by the mother. The child sipped the ecoction, until it lost the power of holding the cup; it became insensible nd paralyzed, and died in the chair in a sitting posture. There were no orbid appearances, and no hemlock leaves were found in the body, these aving subsided in the cup, and being left in the dregs. The child had been oisoned by the upper stratum of clear liquid. The mother was acquitted r want of proof, the death of the child having taken place in secrecy.

Analysis.—Hemlock is known from most other plants which resemble it y its large round smooth stem, with dark purple spots. The leaves are of dark-green colour, and smooth and shining. Every portion of the plant as a peculiar and disagreeable smell when bruised, resembling cat's urine, or, ccording to some, the odour of mice. It is strongly brought out when the tem, leaves, or seeds are rubbed with a solution of caustic potash. We subjoin an illustration of the *seeds* of hemlock, which are peculiar in their form, and are easily distinguished from the seeds of other umbelliferous plants. A person may be poisoned by a decoction of *leaves* of hemlock, and no leaves be found in the stomach or bowels (case of *Bowyer*, supra). In this case the stomach had been emptied, and the contents lost, before it was sent to me! No trace of conia was found. The prisoner first gathered the *Anthriscus sylvestris* by mistake for *Conium maculatum*, but it was proved that she had afterwards gathered the leaves of hemlock. A leaf of each of these plants was copied by photography, and produced as evidence in Court.



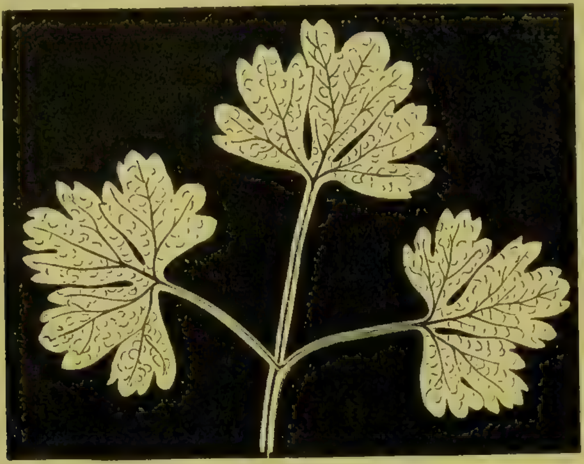
a Seed of Hemlock, natural size.
b The same, magnified 30 diameters.
c Group of Seeds.

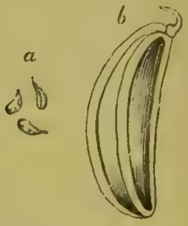
As the determination of the presence of fragments of leaves in poisoned quids, and in the contents of a stomach, may be of importance as evidence, we subjoin an illustration of hemlock leaves, engraved from a photograph of the living plant. The appearance and smell of the leaves, either when bruised or when rubbed with a solution of potash, will greatly aid a medical witness in forming a judgment, as there are many umbelliferæ which bear a close resemblance to hemlock in the form of their leaves. Among these, however, it is impossible to rank common parsley. It is hardly credible that a mistake of this kind should be made, yet through carelessness and ignorance accidents may occur. In August, 1864, a lady and two of her children, residing in the neighbourhood of Liverpool, were seized with symptoms of poisoning soon after dinner. The medical gentlemen who were called in examined the remains of some soup which had been eaten for



Leaf of Common Hemlock.

dinner, and they detected fragments of the leaves of hemlock amongst the herbs which had been used to flavour the soup. Under treatment, the symptoms abated in a few hours, but they did not entirely recover until after two or three days. It turned out that the hemlock had been gathered in the garden belonging to the family, where it was growing side by side with parsley. As the parsley was raised from seed, it is probable that hemlock seed had been accidentally mixed with it by the seedsman, and thus the accident had occurred. We subjoin an illustration from a photograph of a leaf of parsley; also illustrations of the seeds, by which the differences between hemlock and parsley will be at once apparent.


Leaves of Garden Parsley, from a photograph.



Seeds of Garden Parsley.
a. Natural size.
b. Magnified.

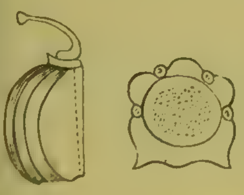
Conia.—The alkaloid of hemlock is known under the names of conia, conein, conicine, and conicina. It resembles nicotina and ammonia in its liquidity, volatile reaction, and in some of its chemical properties. It is a liquid of oily consistency, of a pale yellow colour, powerfully alkaline, and has, when its vapour is diluted, a smell resembling that of mice, and an acrid bitter taste. It gives a volatile greasy stain to paper, and burns with a yellow flame and thick smoke. 1. It is not coloured or affected by nitric, sulphuric, or hydrochloric acid; the last-mentioned acid produces with it, dense white fumes of hydrochlorate of conia, and on heating the mixture, this salt remains in prismatic crystals. 2. It is not dissolved by water, but floats on it in oily globules. 3. It is soluble in alcohol and ether, and this last-mentioned liquid removes it from its aqueous solution, and leaves it in oily globules on evaporation. 4. It gives a white precipitate with corrosive sublimate, and a yellow precipitate with arsenio-nitrate of silver. 5. It precipitates brown oxide of silver from the nitrate: this is not dissolved by an excess, but the oxide is blackened and reduced. 6. Iodine water gives a reddish brown precipitate, which is redissolved; an excess of iodine water causes a yellowish precipitate. 7. It gives a yellow crystalline precipitate with chloride of gold, but no precipitate with chloride of platinum. 8. Tannic acid precipitates it of a dingy white. 9. Gallic acid gives no precipitate, but slowly acquires a yellowish colour. Its odour and insolubility in water, as well as several of the characters above mentioned, serve to distinguish it from nicotina and ammonia; but it may be readily separated from ammonia by the chloriodide of potassium and mercury, which precipitates it even more completely than tannic acid. Conia discharges the colour of a solution of permanganate of potash more readily than ammonia, but more slowly than nicotina. In reference to its presence in *organic mixtures*, it may be detected by its peculiar odour, or by distilling the liquid with a solution of potash and examining the distillate.

The reactions produced by tests on small quantities should be distrusted, nless there is strong corroborative evidence of the action of the poison on he body from the symptoms. As in reference to strychnia, an incautious perator may readily come to the conclusion that he has found 'traces,' and scribe death to the poison. A case referred to under strychnia (page 343) ad its parallel in Germany a few years since. A man died very suddenly, *i.e.* in wo hours and a half after going to bed, and it was alleged that his wife had oisoned him. The persons commissioned to make the analysis deposed that hey had found traces of conia in the stomach, intestines, and kidneys, and hey came to the conclusion that the man had died from the effects of hemlock, hich implicated his wife in a charge of murder. Some doubt appears to ave arisen in the minds of the authorities on this point, and they submitted hree questions for the consideration of a Medical college. 1. Is there any eason to doubt whether conia has really been found in the body of deceased? . If existing in the body, may it have been spontaneously produced, or does show administration from without? Does its detection in the body inconestably prove that the deceased died from poisoning by conia or hemlock? . Is it improbable that deceased poisoned himself with hemlock? The ollege decided that there was not sufficient evidence to show that death had een caused by hemlock. The matter was then referred to Mitscherlich and asper, of Berlin, and they found that the chemical processes pursued, failed o detect conia in the body—that there was nothing to indicate that deceased ad taken hemlock or conia in any form, and that the state of the windpipe ufficiently accounted for the sudden death of deceased. He had eaten and runk freely, had vomited after going to bed; a portion of the food had ntered the trachea and had suffocated him! (See Casper's 'Vierteljahrschrift,' 859, p. 194).

Water-Hemlock. (Cicuta Virosa.)

The water-hemlock has given rise to several fatal accidents—its roots having een mistaken for parsnips. The whole of the plant is poisonous; but the oots are the most active, especially when gathered early or late in the year.

Symptoms and Effects.—The symptoms produced by the roots are giddiness, imness of sight, headache, and difficulty of breathing. There is burning pain the stomach, with vomiting, and these symptoms are accompanied by heat nd dryness of the throat. Convulsions have been observed to precede death. n the cases of three children who died in convulsions from this poison, Mertzorff found an injected state of the mucous membrane of the stomach, with redness of the air-passages, as well as of the cardia, and pylorus; the vessels of the brain and the sinuses were filled with dark liquid blood. (Wibmer, 'Cicuta,' 119.) In a fatal case which occurred to Wepfer, the patient, a man, æt. 20, who had eaten a large quantity of the *root*, was found with his face swollen and his eyes projecting. He breathed with great difficulty, and foamed at the mouth. He was seized with a severe epileptic fit: his limbs assumed a tetanic stiffness, and there was spasmodic breathing. He was quite unconious, and speedily died. The only marked appearances were fluidity of the ood, and patches of redness on the mucous membrane of the stomach. Wibmer, loc. cit.)



Seed of Cicuta Virosa magnified (Lindley).

Hemlock Water-Dropwort. (Œnanthe Crocata.)

This umbelliferous plant grows on the banks of rivers, streams, and ditches. is one of the most poisonous of the order, and is considered to be one of e most virulent of English vegetable poisons.

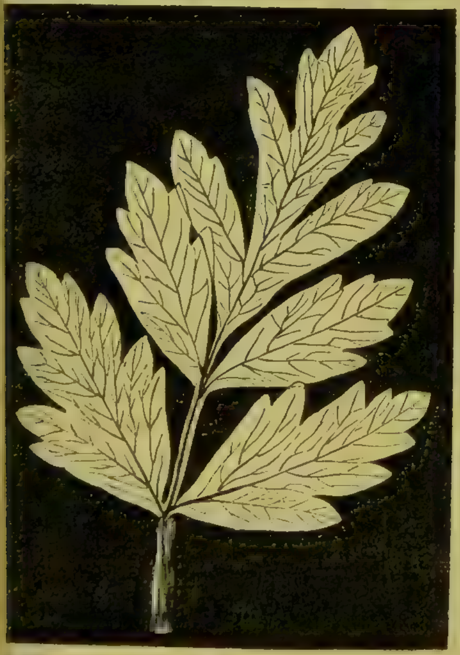
Symptoms and Appearances.—A set of cases of poisoning by œnanthe was communicated to the 'Medical Gazette' (vol. 34, p. 288), by Mr. Bossey, of Woolwich. A number of convicts, while engaged at work, ate the leaves and roots of the œnanthe. In about twenty minutes, one man, without any apparent warning, fell down in strong convulsions, which soon ceased, but left a wild expression on his countenance. Soon afterwards, as many as nine fell into a state of convulsions and insensibility. The face of the man first seized became bloated and livid, there was a bloody foam about the mouth and nostrils, the breathing was stertorous and convulsive, and there was great prostration of strength, with insensibility: he died in five minutes after the symptoms had set in. A second died under similar symptoms in a quarter of an hour, although the stomach-pump was used, and some leaves were extracted with the fluids. A third who had assisted in carrying the two former, was himself seized with convulsions, and died in about an hour; and soon after him, a fourth died, in spite of the most energetic remedial treatment by cold affusion, emetics, stimulants, stimulating frictions, as well as the use of the stomach-pump. Two other cases proved fatal, the one in nine days, and the other in eleven; and in these two cases there was irritation of the alimentary canal. On inspecting the bodies of those who died quickly, there was congestion of the cerebral vessels; and, in one instance, a layer of extravasated blood was found beneath the inner membrane (pia mater). In the first case, which proved most quickly fatal, the cerebral vessels were not congested. The pharynx and gullet had a white appearance, and contained some mucus, with portions of the root. The lining membrane of the windpipe and air-tubes was intensely injected with dark blood. The lungs were gorged with fluid blood. The blood in the heart was very black and fluid. The stomach and intestines were externally of a pink colour: the cavity of the stomach was lined with a thick viscid mucus, containing portions of the root. The mucous membrane was much corrugated, and the follicles were particularly enlarged. Similar appearances were met with in all. In the two protracted cases, the mucous membrane of the stomach and bowels was softened and thickened. It had a pink colour externally, but no red appearance internally. The vessels of the brain were congested. In the others who partook of the roots, the symptoms were not so severe. Under the free use of purgatives, a considerable quantity of the root was discharged, and in a few days the men recovered. These cases show that the œnanthe is a powerful poison. It destroys life with even greater rapidity than arsenic; for it here proved fatal to a strong healthy man in less than *one hour*. Chemists have not yet ascertained on what principle its active properties depend, but they appear to reside chiefly in the root.

In April 1857, two fatal cases occurred at West Boldon in Durham. Two labourers ate some of the roots of the œnanthe. They were found soon afterwards lying insensible and speechless, their faces livid, tongues swollen and protruded, and there were convulsive movements of their teeth, frothy mucus with blood about their mouths, eyes full and projecting, pupils dilated, breathing stertorous and laboured, with occasional general convulsions. They both died in an hour and a half from the time at which they were first discovered. On *inspection*, it was found that there had been bleeding from the ears; the abdomen was livid and swollen. The stomach contained a gruelly liquid with some of the partly digested roots: on removing this liquid, the membrane was found congested and softened. The lungs were engorged with dark liquid blood, and the blood contained in the heart was in a similar state. Mr. Boyle, to whom these cases occurred, forwarded to me a portion of the roots, and there was no doubt that they were the roots of the œnanthe crocata.

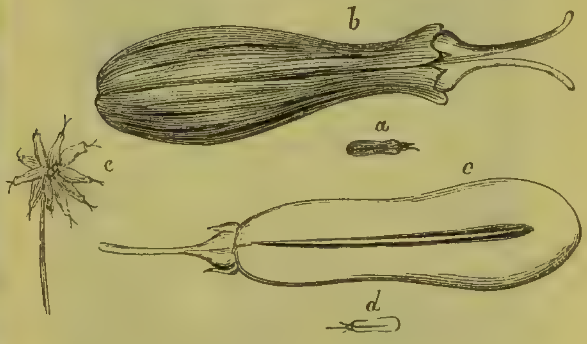
It is not often that attempts are made to destroy others by the administration of these vegetable poisons; but a case occurred in France, in which a

oman attempted to poison her husband by mixing slices of the root of this
lant with his soup. His suspicions were excited by the acrid taste of the
up. The woman was tried for the crime, and M. Toulmouche deposed at
e trial, that the plant from which the root had been taken, was the œnanthe
rocata—that it was a powerful poison, and might cause death in two or three
ours. The prisoner was convicted, and condemned to ten years at the galleys.
Gaz. Med.,' Jan. 3, 1846, 18; also, 'Journ. de Chim. Med.,' 1845, 533.)

Analysis.—The œnanthe crocata can be identified only by its botanical cha-
cters. The leaves are of a dark green colour, with a reddish coloured
order. They have no unpleasant odour when rubbed. The plant bears a
reater resemblance to celery than most of the other umbelliferæ. Its stem
channelled, round, smooth and branched, of a yellowish red colour, and
rowing to the height of two or three feet. The root consists of a series of
blong tubercles with long slender fibres. It is of a yellowish-white colour,
d not unpleasant to the taste. It is the most active part of the plant. The
aves yield much tannic acid to water, but the decoction appears to contain
o alkaloidal base, since the chloriodide of potassium and mercury produces no
recipitate in it. The roots and stems of this plant are more frequently eaten
an the leaves. Nevertheless, it may be occasionally necessary to identify the
ant by the leaves. The annexed engraving is taken from a photograph of the
rger leaves of the œnanthe crocata, grown from the roots of the plant pro-
red from the spot where the two labourers above mentioned had procured
eir fatal meal. The smaller leaves of this plant are much wider in propor-
on to their length.



Part of Leaf of Œnanthe.



Seeds of Œnanthe Crocata.
a Natural size.
b Magnified 30 diameters.
c One half of a seed magnified.
d One half natural size.
e Group of seeds.

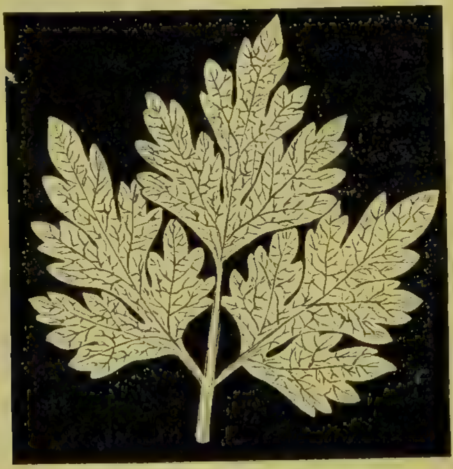
Fool's Parsley. (Æthusa Cynapium.)

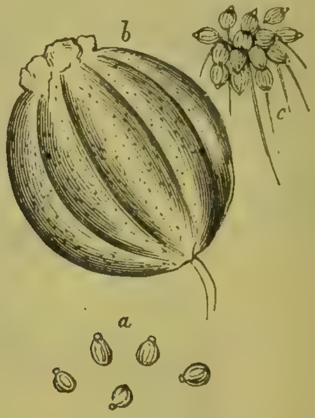
Fool's Parsley, or Lesser Hemlock is very common in gardens and hedge-
ws. The leaves so closely resemble those of parsley that they have often
en gathered for them by mistake.

Symptoms and Appearances.—That the root of this plant contains a most
ergetic poison, and that it is capable of producing rapidly fatal effects, is
oved by a case reported by Mr. Thomas, in which death took place in an
ur. In May 1845, a girl aged five years, in good health, ate the bulbs of
e æthusa by mistake for young turnips. She was suddenly seized with

pain in the abdomen, followed by sickness, but no vomiting. She complained of feeling very ill. On trying to eat, she could not swallow. She was incapable of answering questions, and her countenance bore a wild expression. The lower jaw became fixed, so as to prevent anything being introduced into the mouth. She then became insensible, and died in *an hour* from the commencement of the symptoms: so far as could be ascertained, there were no convulsions. A second child, aged three years, shortly after eating the same substance, was attacked with pain in the stomach, sickness, vomiting, and profuse perspiration. She soon recovered, with the exception of suffering severe griping pains without purging, but these disappeared on the following day. A third child, of the same age, suffered from similar symptoms. Recovery in the two last cases was due to the plant having been eaten on a full stomach, and to the effect of early and copious vomiting. ('Med. Times', Aug. 23, 1845, 408.) The following case occurred to Mr. Stevenson: Two ladies partook of some salad, into which æthusa cynapium had been put by mistake for parsley. They soon experienced nausea, with occasional vomiting; oppressive headache, giddiness, and a strong propensity to sleep, at the same time that this was prevented by frequent startings and excessive agitation. There was a sensation of pungent heat in the mouth, throat, and stomach, with difficulty of swallowing, thirst, and loss of appetite. There was numbness, with tremors of the limbs. The two patients only slowly recovered from the effects of the poison. (Churchill's 'Botany.')

Analysis.—It is known from garden parsley by the smell of its leaves when rubbed, which is peculiar, disagreeable, and very different from that possessed by the leaves of parsley. The leaves of Fool's parsley are finer, more acute, decurrent, and of a darker green colour. They are represented in the annexed illustration, from a photograph of the living plant. Its flower-stem, which is striated, or slightly grooved, is easily known from all other umbelliferous plants by the beard, or three long pendulous leaves of the involucrum under the flower. The flowers are white, those of the garden parsley of a pale yellow colour.


Portion of a leaf of Fool's Parsley, natural size.



Seeds of Fool's Parsley.
a Natural size.
b Magnified 30 diameters.
c Group of Seeds.

The poisonous properties of this plant are believed to be due to an alkaloid, the chemical characters of which are unknown.

MONKSHOOD. (ACONITUM NAPELLUS.)

This well-known garden plant is in some parts of the country called *Wolfsbane*, and in Ireland *Blue-rocket*. The roots, seeds, and leaves are highly poisonous, owing to the presence of the alkaloid *aconitina*; the root is especially noxious, and when the leaves have fallen off, it appears to possess its eatest virulence. These parts of the plant, when masticated, produce a culiarly cool numbing sensation, affecting the lips, tongue, and interior of e mouth generally. At first the root appears to be tasteless, as the effects e only manifested after twenty minutes or half an hour. From tasting only mall portion of the dried root, I found that this disagreeable sensation re- ined on the tongue and lips for four hours. In larger quantity the taste s been described as burning, and it is stated to have been followed by a hot rid sensation in the throat.

Symptoms and Appearances.—In from a few minutes to an hour after the ison has been taken, the patient complains of numbness and tingling in the uth and throat, which are parched :—there is giddiness, with numbness d tingling in the limbs, a loss of power in the legs, sometimes frothing at mouth and severe pain in the abdomen, followed by vomiting and purging. some cases the patient is completely paralyzed but retains his conscious- ss : in others the giddiness is followed by dimness of sight, delirium, and ier cerebral symptoms, but not amounting to the complete coma produced the cerebral or narcotic poisons. The pupils are dilated, the pulse sinks, skin is cold and livid, and the breathing is difficult. Convulsions are not nmonly observed in man, or they are indicated by general tremors or itchings of the voluntary muscles. The poison produces convulsions in mals.

Root.—Poisoning by the *root* of aconite is by no means unfrequent. In spring or autumn, the root is liable to be mistaken for that of horseradish. has been thus accidentally eaten on several occasions and has caused death. mistake of this kind led to fatal results in three hours in a case which urred at Lambeth ; and another set of cases occurred at Dingwall, in otland, in January 1856. Here three persons were poisoned by reason of ir having had sauce made with the root of aconite, served at dinner with st beef in place of horseradish sauce ! They were healthy adults ; they died within three hours and a half. Mistakes of this kind show deplor- e ignorance, but there is always the risk of their occurrence when horse- ish and aconite are grown near to each other in a garden, at that season of year when the leaves have fallen.

A trial for murder by poisoning with the root of this plant took place at Monaghan Lent Assizes in 1841 (*Reg.* v. *McConkey*), in which Dr. oghegan, of Dublin, conducted the medico-legal investigation. The medical dence was beset with difficulties ; for no trace of the poison could be dis- ered in the body, and it was only by a close analysis of symptoms and earances, that the charge was brought home to the prisoner. The de- sed had eaten for his dinner some greens dressed for him by the prisoner ; complained of their having a sharp taste, and this was perceived also by ther person present who tasted them. It was ascertained that the de- sed, soon after the meal, had vomited a greenish matter, and suffered from ging, restlessness, incoherence, lock-jaw, and clenching of the hands. He l in about three hours after having eaten the greens, but was not seen by edical man while living. The chief appearance met with was in the nach, where the mucous membrane was of a light reddish-brown colour. ces of vegetable matter were found in the intestines : but no poison could letected either botanically or chemically. The symptoms suffered by a nd of the deceased, who had accidentally tasted the greens, were very acteristic of poisoning by aconite. In *two* minutes he felt a burning in the mouth, throat, gullet, and stomach ; then a sensation of swelling he face, with a general feeling of numbness and creeping of the skin. lessness, dimness of sight, and stupor almost amounting to insensibility, wed ; and in about an hour after the meal, he was found speechless,—

frothing at the nose and mouth, the hands and jaws clenched, appearing occasionally as if dead, and then again reviving. Vomiting, purging, tenderness at the pit of the stomach, cramps, tingling of the flesh, and a burning taste in the mouth followed. This man did not entirely recover until after the lapse of five weeks. The prisoner was convicted of murder, and confessed before her execution that the powdered *root* of aconite had been mixed with pepper and sprinkled over the greens. ('Dublin Med. Journal,' vol. 19, p. 403.)

It is stated that one drachm of the dried root has proved fatal: but it is probable that less than this would cause death. In November 1856, Mr. Hadfield forwarded to me four small slices of aconite root, taken from the stomach of a man who had died in three hours. The quantity which he had swallowed with suicidal intention was unknown: but none was thrown off by vomiting so far as could be ascertained. The *symptoms* within half an hour of death were burning pain in the stomach, parched mouth,—intense thirst,—retching and vomiting of a tenacious mucus, cold perspiring skin,—imperceptible pulse and a feeling of deadly sickness. The patient was conscious: there were no convulsions. On *inspection*, there was congestion of the brain as well as of its membranes; the heart was flaccid, and there was some blood on the right side. The stomach contained much half-digested food, with four slices of aconite root apparently unaltered. The mucous membrane presented a slight reddish-brown patch at the greater end of the size of half a crown. It was otherwise healthy as well as the other organs. (For an account of the effects of this plant I must refer the reader to a paper by Dr. Geoghegan, 'Dub. Jour. Med. Sci.' vol. 19, p. 403.)

The tincture of the root operates powerfully in small doses. The late Dr. Male of Birmingham died from the effects of not more than *eighty drops* taken in ten doses, over a period of four days,—the largest quantity taken at once being *ten* drops. ('Prov. Med. and Surg. Journ.' August 20, 1845, p. 535; also 'Med. Gaz.' vol. 36, p. 861.) The late Dr. Pereira informed me that he had known tingling and general numbness of the limbs produced in hysterical females by a dose of only *five minims* of a carefully prepared tincture. Dr. Topham has published an account of the symptoms produced by *fifteen minims* of the tincture of the root of aconite. Immediately after taking the poison in a mixture into which it was put by mistake, the patient (a woman, æt. 27) felt a sensation of numbness in the tongue, with difficulty of swallowing. There were convulsive twitchings of the muscles of the face, and she lost the power of walking. There was complete unconsciousness, which continued for two hours, when she began to recover. The pupils were observed to be slightly contracted. The intensity of the symptoms varied at intervals, and came on in paroxysms. They indicated great disorder of the nervous system. The next day she had numbness in both arms, but she rapidly and perfectly recovered. ('Lancet,' July 19, 1851, p. 56. See also the account of a case of recovery in 'Amer. Journal of Medical Sciences,' January 1862, p. 285.)

In January 1853, a woman took by mistake *seventy minims* of *Fleming's tincture* of the root mixed with one grain of acetate of morphia. In a few minutes she became very thirsty, complained of a burning sensation and pain in her stomach, to relieve which she swallowed a quantity of cold water. In fifteen minutes there was violent vomiting, which continued for two hours. She lost the power of standing, and was very restless. The pain in the stomach increased, and there were convulsive movements of the muscles. She was conscious until shortly before her death, which took place in about four hours after she had taken the poison. There were no general convulsions: the pain in the stomach was well marked throughout. On *inspection*, e membranes of the brain were found congested, but the brain itself was m and healthy. The lungs were healthy: and the heart was flaccid, the erus congested. The stomach contained some mucus, and the membrane the larger curvature was injected (reddened) in patches, but otherwise tural. The mucous membrane of the duodenum was in a high state of flammation, abraded in patches, softened, and broken down. Some spots ere of a very dark colour, passing into mortification. In October 1852 an cise officer lost his life by merely tasting Fleming's tincture of aconite, der the supposition that it was flavoured spirit. He was able to walk from e Custom House over London Bridge, but he died in about four hours after king the poison.

The case of the man *Hunt* who, in November 1863, destroyed his wife and ildren by prussic acid, presents some features of interest in reference to the mptoms and appearances produced by tincture of aconite. The quantity of cture taken by him was not determined; but the man was soon afterwards zed with violent spasmodic retching, face pale, skin cold and clammy, pulse all and hardly perceptible, and the action of the heart feeble. The pupils re much dilated, and the eyes brilliant and sparkling; the breathing quiet d regular, except during the fits. He complained of pain in his heart. In empting to walk, he staggered, and had no power to raise his arms. He was fectly conscious,—called for writing materials, and wrote a few lines. He n became suddenly worse, and a quarter of an hour before his death he all power and sensation in his limbs, the sharpest pinches producing no pression. The pulse was imperceptible. There were no convulsions, but mplete relaxation of the limbs at death, which appeared to arise from cope three quarters of an hour after he had taken the poison. On *inspec-* forty-two hours after death, there was great rigidity of the muscles. The stance of the brain was firm and healthy: the vessels on the surface were d with blood. The heart was healthy: the right side was greatly dis- ded with dark fluid blood; the left side contracted and quite empty. The gs were healthy. In the abdomen the viscera were healthy, with the ex- tion of the stomach and duodenum. Mr. Puckle, to whom I am indebted the above particulars, brought the stomach to Guy's Hospital, and we ex- ned it together. There was great capillary congestion at the larger end of stomach, the mucous membrane having a bright red colour. There were ks of irritation, with softening and separation of the mucous lining, the le of the membrane being in a highly corrugated condition. Traces of itina were found in the contents of the stomach. The deceased had pro- d himself with an ounce of the tincture of aconite, and had swallowed greater part of this mixed with water.

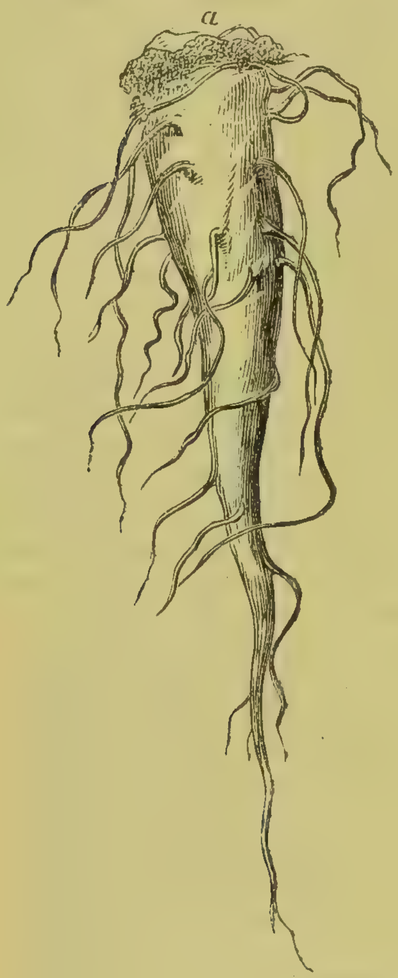
he tincture varies much in strength. In the 'Lancet,' vol. 2, 1861, p. 170, stated that a lady recovered who had swallowed two teaspoonfuls by mistake audanum. She had been in the habit of taking large doses of laudanum. r she had swallowed the aconite she could not rise from her seat, and ex- ned that she had lost the use of her legs. She complained of a burning ation in the throat and constriction at the chest. Her mind was clear, she had the consciousness of no feeling in her arms and legs. The symp- subsided in two hours, and she recovered in eight hours. Vomiting had early promoted by emetics.

November 1862, a case was communicated to me by Dr. Vachell, of iff, in which a man died from the effects of two grains of the extract onite taken in two pills. As in other cases in which active poisons have administered in pills, the symptoms were a long time in appearing, but n they once commenced, they proceeded rapidly to a fatal termination.

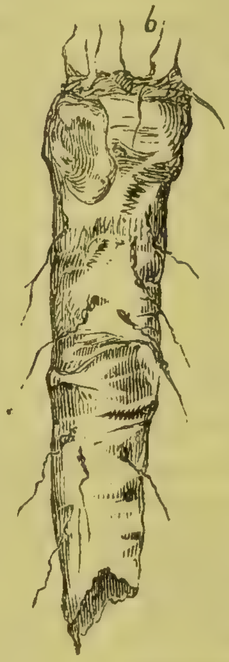
well-marked case of poisoning by a *decoction* of this plant occurred to

Mr. Sayle. A man, æt. 39, boiled the fresh stalks and leaves of aconite in half a pint of beer until it was reduced to a quarter of a pint: he then swallowed half of it as a medicine. An hour afterwards he was found in bed, rolling his arms about and foaming at the mouth:—the pupils were widely dilated, the legs were paralyzed, the skin was cold and clammy, there was great nausea, the pulse was scarcely perceptible, and he was perfectly insensible. He soon afterwards died. The abdomen was examined, and the only appearance met with was a slight redness near the cardiac extremity of the stomach. ('Med. Times,' Oct. 18, 1845, p. 70.)

Analysis.—The botanical characters of the leaves and root, when any portions can be obtained, will enable a medical witness to identify this vegetable poison. The root has been frequently and fatally mistaken for horseradish, but there are these striking differences: — 1. Aconite root is very short, conical, and tapers rapidly to a point. 2. It is externally of an earthy-brown colour, —internally white and of an earthy smell,—the cut surface is rapidly reddened by exposure to air. It has numerous long thin fibres proceeding from it. 3. It has at first a bitter taste, but after a quarter of an hour or twenty minutes it produces a disagreeable sense of tingling and numbness on the lips and tongue. 1. Horseradish root is long, cylindrical or nearly so, and of the same thickness for many inches. 2. It is externally whitish-yellow, and has a pungent odour when scraped. 3. Its taste is sometimes bitter, but it produces an immediate hot or pungent sensation.



a. Root of Aconite.

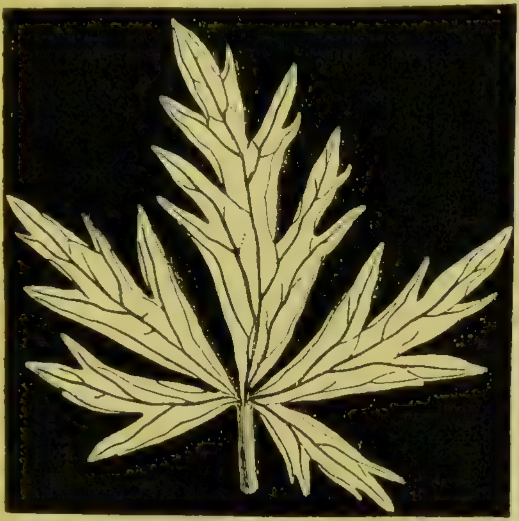


b. Root of Horseradish.

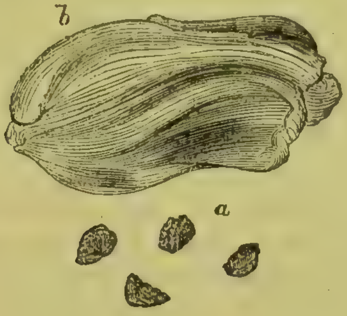
The leaves of aconite or monkshood are of a dark-green colour and of a peculiar shape. The illustration at p. 357 is engraved from a photograph of a fresh leaf. When masticated they slowly produce on the lips and tongue the persistent sense of tingling and numbness, with the sense of coolness, observed in the root. They are less powerful than the root and seeds. The seeds differ in appearance from those of other poisonous plants. (See p. 357.)

ACONITINA.—The alkaloidal base of this plant, *Aconitina*, is a formidable poison, exceeding all others in its effects. In one case one-fiftieth part of a grain nearly proved fatal to an elderly lady (Pereira, 'Mat. Med.,' vol. 2, pt. 2, p. 695); and it is probable that *one-tenth* part of a grain of pure aconitina would prove fatal to a human being. Some samples of this alkaloid are, however, much less potent than others, and the chemical properties are also different. (See paper by Schroff, 'Reil's Journal für Toxikologie,' 3rd H.

1857, p. 335), and one by Liégeois ('Chem. News,' Oct. 24, 1863, p. 201). This contains the account of a simple method for its extraction.



Small Leaf of Aconite, natural size, from a photograph.



a. Seed of Aconite, natural size.
b. The same, magnified 30 diameters.

Analysis.—A sample of English aconitina possessed the following proper- es:—It was in whitish granular masses, without any distinctly crystalline ructure. 1. When heated it readily fused and burnt in the air with a bright ellow flame. 2. Heated in a close tube, it evolved first an alkaline and then n acid vapour. 3. It was scarcely soluble in water, but was dissolved by eak acids and alcohol: it did not readily crystallize. 4. Nitric acid dis- olved it without causing any change of colour. 5. Sulphuric acid gave to it yellowish colour, and green oxide of chromium was separated on adding to a crystal of bichromate of potash. Aconitina cannot be separated from its olutions in a crystalline state by the addition of ammonia. 6. Tannic acid id the chloriodide of potassium and mercury readily precipitate the alkaloid.

Aconitina is sufficiently soluble in ether to allow of its separation from *ganic liquids* by the process of Stas (see page 339). Dr. Headland recom- ends as a physiological test the production of an alcoholic extract of the ntents of the stomach and its application to animals. One-twentieth of a ain will be sufficient: the 1-300th of a grain will poison a mouse; the -100th, a bird; and 1-1000th causes tingling and numbness of the tip of e tongue. The 1-100th of a grain dissolved in spirit and rubbed into the in, causes loss of feeling, lasting for some time. ('Lancet,' March 29, 1856, 343.) There is a great difference in the properties of this alkaloid accord- g to the mode in which it is prepared (Bouchardat, 'Ann. de Thérapeutique,' 64, pp. 48 and 54; also, 'Annuaire,' 1863, p. 41.)

CHAPTER 30.

ROPA BELLADONNA OR DEADLY NIGHTSHADE—POISONING BY ATROPIA—LOBELIA —FOXGLOVE. DIGITALINE—DATURA STRAMONIUM, OR THORNAPPLE—DATURA ALBA AND FASTUOSA. DATURIA—LABURNUM—TAXUS BACCATA OR YEW.

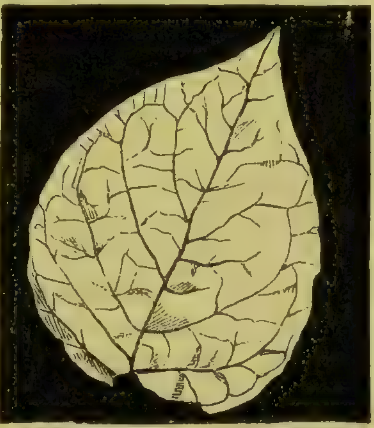
Deadly Nightshade (Atropa Belladonna).

mptoms.—The symptoms which are produced by the leaves, berries, l root of belladonna are of a uniform character, and, as a summary, they y be thus described:—Heat and dryness of the mouth and throat, nausea, niting, giddiness, indistinct or double vision, delirium, great excitement, convulsions, followed by stupor, and lethargy. The pupils are much dilated, and the eyes are insensible to light. In two cases which occurred to Mr. Tufnell, the pupils were contracted during sleep, although dilated in the waking state. ('Dublin Med. Press,' Jan. 5, 1853. 'Journal de Chimie Médicale,' 1853, p. 695.) Several deaths from the poisonous effects of the *berries*, occurred in London in 1846. The following case was admitted into Guy's Hospital:—A boy, æt. 14, ate, soon after breakfast, about thirty of the berries of the belladonna, which he had bought as fruit in the streets. In about three hours, he had the sensation of his face being swollen: his throat became hot and dry, his vision was impaired, objects appeared double, and they seemed to revolve and run backwards. His hands and face were flushed, and his eyelids swollen: there were occasional flashes of light before his eyes. He tried to eat, but could not swallow on account of the state of his throat. In endeavouring to walk home he stumbled and staggered; and he felt giddy whenever he attempted to raise his head. His parents thought him intoxicated: he was incoherent,—frequently counted his money, and did not know the silver from the copper coin. His eyes had a fixed, brilliant, and dazzling gaze; he could neither hear nor speak plainly, and there was great thirst; he caught at imaginary objects in the air, and seemed to have lost all knowledge of distance. His fingers were in constant motion: there was headache, but neither vomiting nor purging. He did not reach the hospital until nine hours had elapsed; and the symptoms were then much the same as those above described. He attempted to get out of bed with a reeling, drunken motion; his speech was thick and indistinct. The pupils were so strongly dilated that there was merely a ring of iris, and the eyes were quite insensible to light. The eyelids did not close when the hand was passed suddenly before them. He had evidently lost the power of vision; although he stared fixedly at objects as if he saw them. The nerves of common sensation were unaffected. When placed on his legs he could not stand. His pulse was 90, feeble and compressible: his mouth was in constant motion, as if he were eating something. His bladder was full of urine on admission. He continued in this state for two days, being occasionally conscious, when by a free evacuation of the bowels, some small seeds were passed: these were examined and identified as the seeds of belladonna. The boy gradually recovered, and left the hospital on the sixth day after his admission:—the progress of recovery was indicated by the state of the pupils, which had then only acquired their natural size and power of contraction. In three other cases which occurred at the same time, the berries having been baked in a pie, pains in the limbs, drowsiness, insensibility, and convulsions, were among the symptoms. In two instances of poisoning by the berries related by Dr. Moll, the symptoms bore a strong resemblance to those of delirium tremens, but among them were heat and dryness of the throat, loss of power of swallowing, incoherent speech, double vision, and strange spectral illusions, with occasional fits of wild and ungovernable laughter. On the following morning both these patients recovered as if from a dream; but they suffered for some time from languor, thirst and dryness of the throat: the pupils also continued dilated. (Casper's 'Wochenschrift,' 10 Jan. 1846, p. 26.) Two cases, showing the poisonous effects of the berries on children, are quoted in the 'Edinburgh Medical and Surgical Journal.' (Vol. 29. p. 452.)

The *root* of the belladonna, administered in the form of decoction as a clyster, has destroyed life. Four scruples of the root were employed, and the liquid, strained and reduced by evaporation to four ounces, was injected. After a slight stage of excitement, the patient, a female, æt. 27, fell into a state of complete coma; the countenance appeared swollen, and of a reddish-brown colour; the pulse was at first full nd hard, then small; death took place in five hours. (Casper's 'Wochens.' 3 Feb. 1845, p. 101.)

The *leaves* of belladonna have occasionally given rise to accidents. A young man swallowed an infusion of two drachms of the leaves. In about n hour he found great difficulty in swallowing, the salivary secretion was uppressed, and objects appeared to be in perpetual motion before him. He ecame delirious, attempted repeatedly to pass his urine but could not: and or an hour and a half he was in constant motion, although his gait was nsteady. The muscles of his face, jaws, and limbs were agitated by con-ulsive twitchings: the pupils were excessively dilated, and there were ingular hallucinations. There was neither nausea, vomiting, nor purging. Emetics, injections, and bleeding were resorted to, and the next morning the atient awoke as if from a dream. ('Ann. d'Hyg.' Oct. 1847, p. 413.)

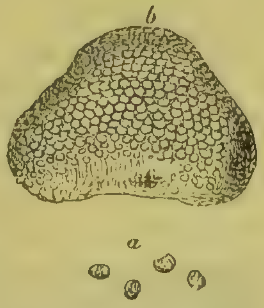
Leaves of belladonna have been ignorantly supplied for ash-leaves, and alf a wine-glassful of the decoction of the leaves produced on Dr. Garrod he usual symptoms of poisoning by this plant. His patient, who took half a pint, suffered severely. The chief symptoms were giddiness, difficulty in alking, dryness of the mouth and throat, and erversion of taste, indistinctness of vision, ilatation of the pupils, bloodshot eyes, difficult rticulation, delirium, insensibility, and a scarlet edness of the skin of the face and neck, followed y a peeling off of the cuticle. The leaves of elladonna are peculiar in shape. The annexed llustration is from a photograph of a small leaf of he fresh plant. According to Mr. Luxton, 1,000 rains of leaves yield only five grains of atropia. See 'Pharm. Journal,' 1855, p. 300.)



Small Leaf of Belladonna, natural size.

The *seeds* of belladonna are small, of a somewhat oval shape, and of dark colour. Under a low magnifying power they have a somewhat oneycombed surface. In henbane the surface of the eeds presents more irregular depressions, resembling hose seen on certain corals or madrepores. (See . 329.)

Two persons swallowed a small spoonful of the *ex-ract* of belladonna by mistake for that of juniper. here was speedily indistinctness of vision, tottering ait, delirium, incoherency, hallucinations, and dilata-ion of the pupils. In one there was great cerebral xcitement. The apothecary to whom the extract was aken tasted it, and soon experienced symptoms which ed to a suspicion of its real nature. Under treatment, e symptoms of poisoning disappeared in two days; ut one of the patients died on the seventh day from disease. The physical nd physiological properties of the extract indicated that it was belladonna; ut the attempt to procure atropia from it entirely failed. A portion of the ncentrated extract given to a dog, caused dilatation of the pupil in a uarter of an hour,—an index of the rapidity with which the alkaloid atropia s absorbed into the blood.

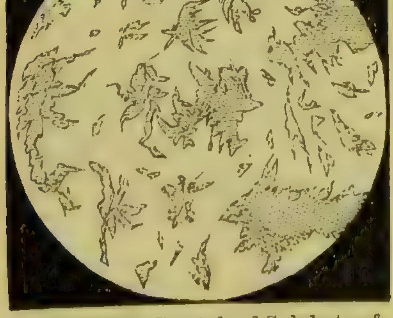


Seeds of Belladonna.
a. Natural size.
b. Magnified 30 diameters.

Appearances.—The appearances observed in several cases of poisoning by e berries which proved fatal in London during the autumn of 1846, were s follows: the vessels of the brain were congested with liquid blood; the tomach and intestines were pale and flaccid; there were some red spots owards the cardiac end. In other fatal cases, of which the appearances have been reported, the vessels of the brain and its membranes were found distended with thick black blood. Red spots have also been observed around the throat and gullet, and congested patches of a dark purple colour on the coats of the stomach. In some instances the mucous membrane has been completely dyed by the juice of the berries. A boy, æt. 5, after having eaten a quantity of the berries of the belladonna, went to bed, was very restless, vomited once, and died in convulsions about fifteen hours after having taken the poison. On inspection, the eyes were half-open, with an intense lustre; the pupils dilated; the mouth was spasmodically closed and the sphincter ani relaxed. The cerebral vessels were distended with dark-coloured blood: the substance of the brain, cerebellum, and medulla oblongata, presented numerous bloody points. In the throat and gullet there were several patches of redness. In the stomach there was some fluid, with three open berries; the mucous membrane was of a reddish-blue colour in various parts. (Case by Dr. Rosenberger, Canstatt's 'Jahresb.' 1844, v. 295.)

Analysis.—The indigestible nature of the leaves, fruit, and seeds will commonly lead to their detection in the matters vomited or passed by the bowels, or in the contents of the viscera after death. The seeds of belladonna are very small,—they can, however, be distinguished by the microscope from the seeds of other poisonous plants. The colouring matter of the berry is of a deep purple hue: it is turned green by alkalies, and red by acids. The leaves would be known by their botanical characters, and a decoction or infusion of them by the liquid causing dilatation of the pupil. Dr. Runge states that the urine, blood, or organic liquids containing this poison, applied to the eye of an animal, cause dilatation of the pupil. Orfila did not observe this effect in poisoning by belladonna (op. cit. ii. 267), and even if it occurred, he considered that it would be too vague a sign for diagnosis, as it may take place equally with henbane and stramonium.

Atropia.—Atropia is the name given to the alkaloidal principle of belladonna. This alkaloid is a powerful poison. In November 1850, Mr. Sells, of Guildford, forwarded to me for examination the stomach of a young man who had poisoned himself by taking *two grains* of atropia. He took the dose on going to bed. He was heard to snore heavily during the night, and was found dead about seven o'clock in the morning, lying on his right side, the surface livid, the limbs rigid and contracted, and with a little brown matter issuing from the mouth. The pupils were much dilated. The mucous membrane of the stomach presented a diffused redness, which might have arisen from some brandy which he had swallowed. No trace of the poison could be detected in the stomach or its contents. In the 'Association Medical Journal' (Sept. 16, 1853, p. 818) will be found the report of a case in which all the symptoms of poisoning by belladonna arose from the application of a weak solution of atropia and water to the conjunctiva. One-eighth of a grain injected into the skin for the relief of sciatica, produced all the symptoms of poisoning. ('Pharm. Journal,' May 1862, p. 583.)



Imperfect Crystals of Sulphate of Atropia magnified 30 diameters.

Analysis.—Atropia is a white crystalline substance, not very soluble in water, but easily dissolved by alcohol, ether, and diluted acids. It does not readily crystallize, but it forms crystallizable salts. The annexed illustration shows the irregular crystalline form of the sulphate of atropia, as it is deposited from an alcoholic solution. Ammonia added to the solution of sulphate of atropia does not separate the alkaloid in distinct crystals.

In this respect it differs from morphia and strychnia. When atropia is heated on platinum it melts, darkens in colour, and burns with a yellowish smoky flame. Sulphuric, hydrochloric, and nitric acids dissolve it without any change of colour. Water added to the mixture of sulphuric acid produces no change: but a crystal of bichromate of potash produces a green colour from the formation of oxide of chromium. Tannic acid precipitates the alkaloid from its solutions: but the most effectual precipitant is the chloriodide of potassium and mercury, which throws down a dense white precipitate even in very diluted solutions. Atropia is also precipitated by chloride of gold, but, like strychnia, it is not precipitated by sulphocyanide of potassium or chromate of potash. It may be detected in, and separated from, organic liquids by the process of Stas. (See page 329.)

A small quantity of a diluted solution of atropia applied to the eye produces dilatation of the pupil. This may be employed as a physiological test for the presence of atropia in an extract from the contents of the stomach, or of any organic liquid. The introduction of a portion into the cellular membrane of an animal, besides producing the ordinary symptoms of poisoning, causes dilatation of the pupil.

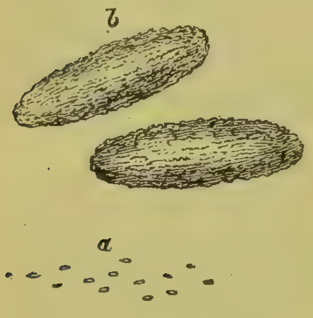
INDIAN TOBACCO. (LOBELIA INFLATA.)

The powdered leaves of Indian tobacco contain an acrid principle which is capable of producing poisonous effects on the brain and spinal marrow, attended with irritation of the stomach and bowels. When administered in doses of from ten to twenty grains, lobelia operates as an emetic; but in larger quantity it acts deleteriously. It would also appear that even ordinary medicinal doses affect some individuals with great severity. There is an erroneous notion that this is a useful medicine and not a poison, although like arsenic and opium it may be either, according to the mode in which it is employed.

In one case a man lost his life by swallowing *one drachm* of the powdered *leaves*, prescribed by a quack. This person was seen by a medical practitioner soon after he had taken the poison: he was evidently suffering great pain, but he was quite unconscious,—the pulse was small, and the pupils were strongly contracted and insensible to light. He had vomited the greater part of the poison. He suffered from spasmodic twitchings of the face, sank into a state of complete insensibility, and died in about thirty-six hours. On inspection, some fluid was found in the stomach, but none of the powder. The mucous membrane was intensely inflamed, and the vessels of the brain were strongly congested. ('Pharm. Times,' May 1, 1847, p. 182.) The *seeds* of lobelia are equally poisonous. In the 'Med. Times and Gazette,' Nov. 26, 1853, p. 568, two cases are reported in which the seeds proved fatal. In one, the mucous membrane of the stomach was highly inflamed. Another case is referred to in the same journal, March 12, 1853, p. 270.

There have been many inquests and trials for manslaughter in this country as the result of the improper administration of the leaves of the *Lobelia inflata* by ignorant quacks, calling themselves medical botanists and dealers in vegetable medicines. The medical evidence given on these trials has proved that in large doses lobelia is a most noxious drug. (See 'Medical Gazette,' vol. 44, pp. 383 and 433; vol. 46, p. 384; 'Lancet,' March 5, 1853, p. 237; 'Pharm. Journ.' Aug. 1851, p. 87; and for some remarks on the action of the poison see a paper by Mr. Curtis and Dr. Pearson, 'Med. Gaz.' 1850, vol. 46, p. 285; also Pereira, 'Mat. Med.' vol. 2, pt. 2, p. 12.) The impostors who profit by the prescription and sale of this drug among the ignorant poor, maintain the doctrine that it cannot kill, and never has been known to destroy life! In July 1856, one of these quacks was convicted on a charge of manslaughter for killing a woman with overdoses of lobelia. Severe pain, followed by loss of consciousness, and congestion of the brain, were the chief symptoms preceding death in this case. The admission that, in proper doses, it was a useful remedy in spasmodic asthma was of no avail on this occasion. The man was sentenced to three months' imprisonment. (*Reg.* v. *Boyden* or *Jackson*, Lincoln Summer Assizes, 1856.) A man named *Riley Drake* was convicted in the United States of having caused the death of a woman by administering lobelia in improper doses. (Wharton and Stille's 'Med. Jur.' p. 522.)

Analysis.—Lobelia is seen in the form of a greenish-coloured powder (fragments of leaves). This powder acquires a reddish-brown colour from strong nitric acid, and is blackened by concentrated sulphuric acid. Iodine water has no effect upon the infusion. The proto- and per-sulphate of iron produce with it a dark-green colour, the persulphate very rapidly. The leaves and seeds contain a resinoid substance called *Lobelin*, which has the smell and taste of the plant. It acts as a powerful emetic in doses of from one half to one grain. The leaves of lobelia are generally seen in fragments which do not readily admit of identification by the microscope. The *seeds* are very small, of a lengthened oval shape, reticulated on the surface with projecting hairs or fibres, and of a light brown colour. The discovery of them among the fragments of leaves would furnish a sufficient proof of the presence of lobelia.



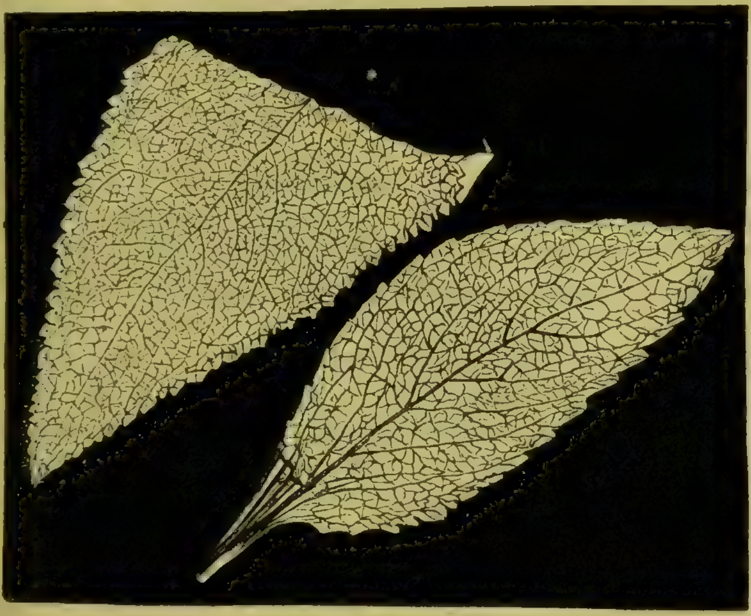
Seeds of Lobelia.
a. Natural size.
b. Magnified 70 diameters.

Foxglove. (Digitalis Purpurea.)

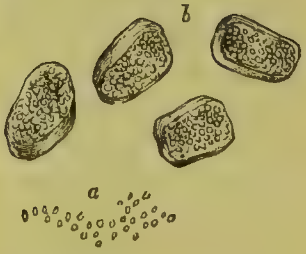
Purple foxglove is a well-known hedge-plant growing abundantly in the southern districts of England. All parts of the plant—the seeds, leaves, and root—are poisonous, owing to the presence of the poisonous principle, *digitaline.* The leaves, whether in the form of powder, infusion, extract, or tincture, exert an action on the brain and spinal marrow, as well as on the stomach and bowels. They retain their noxious properties when dried.

Symptoms and Effects.—Cases of poisoning by foxglove are not very numerous. One was the subject of a criminal trial at the Old Bailey in Oct. 1826. A quack was indicted for the manslaughter of a boy under the following circumstances:—He prescribed for a trivial complaint six ounces of a strong decoction of the *leaves.* The boy was soon attacked with vomiting, purging, and severe pain in the abdomen. After some time, he became lethargic, and slept for several hours; in the night he was seized with convulsions. The pupils were dilated and insensible, the pulse was slow, small, and irregular; coma followed, and the boy died twenty-two hours after taking the poison. On *inspection*, the membranes of the brain were found much injected, and the mucous lining of the stomach was partially inflamed. The prisoner was acquitted of the charge, because he had only given his fatal advice on the application of the friends of the deceased! ('Ed. Med. and Surg. Jour.,' 27, 223.) A young man swallowed a strong *decoction* of foxglove by mistake for purgative medicine. He was soon seized with vomiting, pain in the abdomen, and purging. In the afternoon he fell asleep. At midnight he awoke, was attacked with violent vomiting, colic, convulsions, dilated and insensible pupils; his pulse was slow and irregular. He died twenty-two hours after taking the poison. (Wibmer, op. cit. *Digitalis.*) A few grains of the powdered leaves have been known to produce giddiness, languor, dimness of sight, and other nervous symptoms. A drachm has, however, been taken without causing death; but in this instance, it produced the most violent vomiting. As indicative of the singular effect of this poison on the nerves of sensation, it may be stated that a coal-fire appeared to the patient to have a blue colour. A common effect of this poison is to produce great depression of the heart's action.

Analysis.—When foxglove has been taken in substance, *i. e.* in the form of seeds or leaves, or any portion of these has been swallowed in a decoction or infusion, fragments may be found in the stomach and bowels. In reference to the infusion, decoction, tincture, or extract, except there be sufficient to allow of the separation of digitaline, there is no chemical process known by which the poison may be recognized. If any fragments of leaves or seeds are found in the contents of the stomach or in food, they may be identified by the aid of the microscope. The annexed illustration, taken from the living plant by photography, represents a small leaf and a portion of a larger leaf of this plant.



Leaves of Foxglove.



Seeds of Foxglove.
a. Natural size.
b. Magnified 30 diameters.

It is calculated that digitaline constitutes only one per cent. of the dried leaves. In reference to the *seeds* of foxglove, they are of a reddish-brown colour, remarkably small, oblong, and somewhat angular in shape. They have peculiar markings. By the aid of the microscope, they may be easily distinguished from the seeds of hyoscyamus, datura, belladonna, and most other poisonous plants.

Digitaline.—Digitaline is the active principle of foxglove: its physiological properties have been fully investigated by M. Homolle ('Journal de Pharmacie,' Janvier, 1845-57; also, Bouchardat, 'Ann. de Thérapeutique,' 1864, p. 155). The samples which I have examined have had a pale fawn colour, and no crystalline character. I have found it impossible to crystallize it either by the use of alcohol, ether, or chloroform. Alcohol is its best solvent. Boiling water takes it up in small quantity, acquiring a tea-like odour: its solutions are intensely bitter. It is a neutral vegetable principle, having neither alkaline nor acid reaction. In solution it is precipitated by tannic acid, but not by the chloriodide of potassium and mercury; and by this property it may be distinguished from the true vegetable alkaloids. It forms no salts with acids. When heated in a tube, it melts and is decomposed: it evolves an acid, and not an ammoniacal vapour. Strong nitric acid dissolves it, and gives to it a deep orange-red colour unlike that of morphia or brucia. This acid solution speedily acquires a pale yellow on standing. Iodic acid is unchanged by it. Hydrochloric acid dissolves it, and when gently heated the solution becomes green. Strong sulphuric acid gives to it a brown colour, and after exposure for some time or by a gentle heat this colour changes to a purple black. If the sulphuric acid solution is diluted, the liquid immediately assumes a dingy green colour. Diluted sulphuric acid heated with the powder gives a reddish-black colour. M. Grandeau has suggested an addition to this test. If the digitaline has been previously dissolved and the liquid evaporated, sulphuric acid imparts a rose colour to small quantities, and a reddish-brown or even brown colour when the digitaline is in rather large quantity. If the digitaline, moistened with sulphuric acid, is exposed to the vapour of bromine, it immediately assumes a violet colour. This peculiar colour is observed even with the faintest trace of the principle, and regarded by him as characteristic. Seventeen of the alkaloids and principles thus tested did not acquire a violet colour. ('Chemical News,' July 16, 1864, p. 26.) According to M. Grandeau, digitaline readily admits of separation by dialysis from organic liquids. MM. Tardieu and Roussin have not found this method so successful in practice as these experiments on pure digitaline would appear to indicate. ('Ann. d'Hygiène,' 1864, p. 80.)

M. Homolle extracted from foxglove, by means of alcohol, three substances: an acrid matter soluble in ether, which produced on himself violent vomiting and fearful head-symptoms leading almost to the destruction of life; a highly concentrated bitter principle; and digitaline. The latter alone was proved upon hospital patients to have the power of decreasing the action of the heart, lowering the pulse, and increasing the quantity of urine. ('Pharmaceutical Journal,' Oct. 1861, p. 245.)

Pure digitaline itself operates powerfully on man and animals in very small doses, and it must be regarded as a deadly poison. The 1-16th of a grain, which is considered to be equal to eight grains of the well-prepared powder of the dried leaves, is sufficient to cause symptoms of poisoning. Doses of from 1-11th to 1-32nd part of a grain have lowered the pulse and caused nausea, vomiting, griping, purging, and an increased secretion of urine. (Pereira, 'Mat. Med.,' vol. 2, p. 528.) Doses of from one-quarter to one-half of a grain would probably prove fatal to life. M. Homolle found in experiments on himself that small doses of digitaline taken at intervals lowered the pulse to about one-fourth or one-fifth of the normal standard: thus in himself it fell 17 in one minute, which represents a fourth of the normal pulsations. In doses of from 1-15th to 1-30th of a grain in twenty-four hours, digitaline slackened the circulation. In doses above 1-15th of a grain, it produced on adults emetic and purgative effects, sometimes suddenly, at others slowly and gradually. In doses of from one to two grains, unless speedily thrown off by vomiting, it killed dogs in a few hours. (Orfila, 'Toxicologie,' vol. 2, p. 350.)

Digitaline has acquired some notoriety by reason of the trial of *Dr. De la Pommerais*, at Paris, in May 1864, for the murder of a woman named Pauw. This woman, who was about forty years of age, and in the enjoyment of good health, was suddenly seized with violent vomiting, and, after an illness of about twenty-four hours, died on the 17th November, 1863. The prisoner had just renewed his intimacy with her at the time of the occurrence of this fatal illness; and, after a long interval of absence, he had induced her to insure her life in various insurance offices for an enormous sum of money, quite disproportioned to her circumstances. Immediately after her death he put in a claim for these large insurances. The body of the deceased was exhumed and inspected for the first time on the 30th of November, thirteen days after death. The viscera throughout were healthy; they presented no unusual appearance, and revealed no natural cause of sudden death. The stomach and bowels, which were well preserved, bore no marks of the action of poison; and, on a chemical analysis, no poison of any kind could be detected in these organs by MM. Tardieu and Roussin. The symptoms, during the illness, owing to there being no suspicion of poisoning, were not accurately observed. Repeated vomiting, with great depression and exhaustion, seem to have been the most prominent. Failing to detect any poison by chemistry and the microscope, the experts adopted the physiological test of administering prepared alcoholic and aqueous extracts of the stomach and intestines to animals. An attempt made to separate the active principle and remove the organic matter by dialysis, did not yield satisfactory results. ('Annales d'Hygiène,' 1864, 2, 105.) Seventy-five grains of the mixed extracts above mentioned were introduced into the cellular membrane of the thigh of a dog. The animal vomited twice; and in four hours the pulsations of the heart sank from 102 to 86: its action was irregular and intermittent, and the respiration was deep and painful. There were no narcotic symptoms: on the next day, the dog was better, and it completely recovered. Sixty grains of these extracts in water, administered to a rabbit by means of a funnel, caused death in a few minutes, probably from syncope (or asphyxia?)

Another branch of physiological evidence unexpectedly presented itself. The deceased, during her fatal illness, had vomited on the floor of her room. An alcoholic extract was made of the scrapings of the floor and of the substances deposited between the planks. No mineral poison was found in it. Seventy-five grains of this extract were introduced into the cellular membrane of the thigh of a dog. The animal suffered from vomiting and depression of the action of the heart, and died in about twenty-two hours. There was no coma or insensibility at any time. Thirty-one grains of the same extract diffused in water were administered to a rabbit by means of a funnel. In less than three hours after the injection the animal died, having suffered from irregular and depressed action of the heart. Sixty grains of an alcoholic extract from the scrapings of the floor, said to be free from vomited matters, had no effect upon an animal.

These two extracts of the floor had different chemical properties. The first, containing, as it was believed, a portion of the vomited matters, amounted to half an ounce. It was of a brown colour, had a rancid oily odour, and a bitter taste. Its solution was precipitated by tannic acid: it was coloured purple-red by sulphuric, and green by hydrochloric acid. The second was coloured, had an oily aspect, but no bitterness. It was not precipitated by tannic acid, and was feebly coloured by the sulphuric and hydrochloric acids; the results being different from those obtained with the first extract. It was objected to any inferences from the properties of these extracts, that deceased's room had been formerly occupied by a photographic artist: but it is expressly stated that no noxious mineral substances, such as are used in photography, were found in them. No attempt was made to procure digitaline from the extracts: the presence of this principle was a matter of inference, from the effects produced: and the reason assigned for the extract derived from the stomach and bowels of deceased having no fatal effect upon animals, was that the quantity of the principle left in the body at the time of death was too small.

MM. Tardieu and Roussin deposed at the trial that the deceased had died from a vegetable poison which produces no marked change in the body, which cannot be revealed by chemical analysis, but only by its noxious effects on animals. The effects on animals were in this case similar to those caused by digitaline, and without positively affirming that the deceased woman, Pauw, had died from this poison, there was the strongest presumption that she fell a victim to it. The deceased was quite well the day before her death, and the post-mortem examination of the body proved the absence of any natural cause to account for this sudden death.

In reference to the accused, it was proved that he had in his possession a large number of poisons of a deadly kind, including digitaline,—that he had at three different times purchased as much as fifty-two grains of this poison, of which much had been used, and that those quantities were inconsistent with any reasonable medical requirements. As the prisoner was a homœopathic practitioner, the purchase and actual use of such large quantities of so potent a drug were quite inexplicable on any theory consistent with his innocence. On the other hand, the case was equally against him in its moral aspects; it was clearly established that, by reason of the large insurances effected on her life, he had the strongest motive in the death of the woman, that a long cessation of their intimacy had taken place by reason of his marriage with another person, that he had suddenly and without any reasonable grounds renewed his intimacy with the deceased, and the date of her fatal illness was in accordance with these visits thus renewed. In short, Dr. De la Pommerais had the motive, means, and opportunity of destroying the life of this woman by poison, and no theory consistent with his innocence could be suggested, by those who defended him, to explain satisfactorily the mass of moral and medical circumstances which were clearly proved against him. Further, as with some other criminals, he over-acted his part, and by forged letters and correspondence had shown that he had fully anticipated the sudden death of the woman Pauw, and the explanations that might be required of him in order to account for this event.

Apart from any questions respecting the speculative character of the medical evidence, there were circumstances proved in this case which were inconsistent with any theory of the innocence of the accused. The jury found him guilty of murder, and he was subsequently executed.

THORNAPPLE. (DATURA STRAMONIUM.)

All parts of this plant are poisonous; but the seeds and fruit are considered to be the most noxious.

Symptoms.—The usual effects produced by this poison will be understood from the following cases. A woman, æt. 36, took two teacupfuls of infusion of stramonium leaves by mistake for senna tea. In about ten minutes she was seized with giddiness, dimness of sight, and fainting. In two hours she was quite insensible; the pupils were fixed and dilated, all the muscles of the body convulsed, the countenance flushed, and the pulse was full and slow. The stomach-pump was applied, and in the course of a few hours she recovered,—suffering, however, from indistinctness of vision and vertigo. ('Med. Gaz.,' 8, 605.) The *seeds* of this plant are highly poisonous. A boy, æt. 5, ate some seeds with a portion of the plant. Soon afterwards, it was observed that his face was flushed, and that he staggered as if intoxicated. He vomited and threw up about thirty seeds. His skin was hot and red, the countenance had a wild and staring expression, the pupils were nearly fully dilated, and insensible to light. The child was restless, in a state of raging delirium, and biting with fury at those who attempted to restrain him. He was unable to stand, and in a state resembling St. Vitus's dance. The pulse could not be counted. The breathing was hurried and gasping. He was incessantly talking, but without articulating distinctly, and he appeared to be driving away from him imaginary objects. Emetics produced the vomiting of more seeds, and in an hour he began to articulate. He slept restlessly for two hours. Some seeds were passed in the evacuations from the bowels. In four hours the symptoms had abated, and the boy gradually improved. The pupil did not recover its natural state until after three days. ('New York Journal of Medicine,' 1856; and 'Brit. and For. Med. Rev.,' 1857, vol. 19, p. 497.)

In the 'American Journal of Medical Sciences,' April 1864, p. 552, Dr.

Turner describes five cases of poisoning by the seeds, in children under ten years of age. They had eaten them in the scarcely ripe state when they are not very bitter. In one hour and a half two of the children were found to be fully under the influence of the poison. They were lying on their backs, eyes bright, pupils widely dilated and insensible to light; conjunctiva injected, face deeply suffused and of a dark crimson colour; difficulty of breathing, inability to articulate, and in a state of complete insensibility, broken occasionally by a paroxysm during which they would utter some indistinct sounds and throw the hands about the head as if trying to ward off some threatening evil. They then fell into a comatose state, but were easily roused into a state of violent excitement: they grasped at imaginary objects; there was picking at the bed-clothes, with paroxysms of excessive laughter. They had no proper control over their limbs, walked with a staggering gait, and fell to the ground as if intoxicated or in a state of complete exhaustion. They recovered under treatment in about twenty-four hours. (See also other cases by Dr. Lee, in the same journal, Jan. 7, 1862, p. 54.)

Death may take place although the whole of the seeds are ejected. This happened in a case reported by Mr. Duffin—that of his own child, æt. 2, who swallowed about one hundred seeds of stramonium, weighing sixteen grains. The usual symptoms were manifested in an hour, and the child died in twenty-four hours, although twenty seeds had been ejected by vomiting and eighty by purging. ('Med. Gaz.,' vol. 15, p. 194.) Sufficient daturia to destroy life had been absorbed from the entire seeds and carried into the blood.

In a case which became the subject of a trial at Osnabrück, a woman administered to her mother a decoction of the bruised *seeds* of the thornapple, of which it was supposed there were about 125. She very soon became delirious, threw her arms about, and spoke incoherently: she died in seven hours. (Henke, 'Zeitschrift der S. A.' 1837, i. H.) The seeds retain their properties notwithstanding exposure to heat: thus the smoking of stramonium-seeds is attended with danger. In the return of the Registrar-General for April 1856, there is the record of one death from this cause. One of the methods of poisoning adopted by the Hindoos, not so much with the intention of destroying life as of facilitating the perpetration of robbery, consists of administering to persons either the powdered seeds, or a strong decoction of them, in curry, or some other highly flavoured article of food. Delirium and insensibility soon follow, and sometimes death is the result; but no suspicion of the real cause appears to be excited.

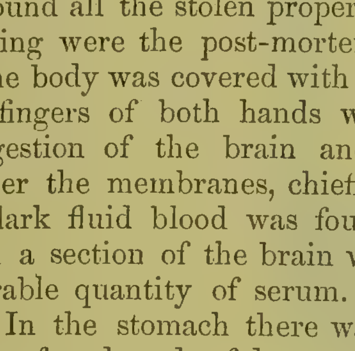
Dr. Brown, of Lahore, states that out of ninety-two of these cases of poisoning no fewer than twenty-one proved fatal, but it is probable that many which result in death are never known, while those who survive would naturally complain of whatever injury had been done to them while insensible. He observes that the drug has a bitter taste which it generally imparts to the food with which it is mixed, and which is sometimes recognized when it is eaten. The symptoms usually occur in about ten minutes after the poison has been taken, although they may be delayed from half an hour to an hour. There is at first dryness in the throat, attended with a feeling of faintness, headache, and giddiness, and the person has difficulty in walking straight, and appears as if intoxicated, while at the same time he is very restless. The pupils of the eyes, if examined, are found to be dilated, and he will sometimes complain of indistinctness of vision, and drowsiness, and he almost always falls asleep. The sleep may either increase to complete insensibility with dilated pupils, a flushed face, and muttering delirium, or the patient may awake and then become delirious. The delirium is characterized by great restlessness, the person affected frequently moving about, and there is a tendency to go naked and to pick at various objects. The pulse is generally slow, the pupils are dilated, and there is great thirst. After a time the patient becomes again insensible and is greatly exhausted: sometimes convulsions occur with low muttering delirium, and at length he dies. If, as it more frequently happens, he recovers, the insensibility persists for a day or more, and the patient remains occasionally in an idiotic state, able to speak, but not to understand for some time longer, and usually has no recollection of what has occurred after his last meal. Sometimes vomiting is an early symptom, although this is rare. ('Description of Poisons in the Punjab,' 1863, p. 57.)

Dr. Chevers has given a very complete account of the Hindoo system of poisoning by *dhatoora*. ('Med. Jur.' for India, 1856, pp. 121, 549, 591.) It appears that the Datura fastuosa and alba are the principal sources of the poison in India. The Thugs have employed this poison with the object of rendering their intended victims helpless. As it is administered by skilled professional poisoners in India, it causes a profound lethargy resembling coma, with dilated pupils. The symptoms may continue for two days, and yet recovery take place. He also states that the cases rarely prove fatal. Out of fifty-one instances of poisoning by dhatoora, at the Bombay hospital in one year recorded by Dr. Giraud, one only proved fatal, and four presented very alarming symptoms. Dr. Chevers notices the early occurrence of insensibility. A man drank two mouthfuls of a poisoned liquid, complained of a bitter taste, and fell down insensible within forty yards of the spot where he had drunk the liquid, and did not recover his senses until the third day after. (Op. cit. p. 137.) In these cases, probably the seeds are given in a large dose, either in solution or in very fine powder. The first stage of poisoning is commonly marked by delirium, the patient is restless and wanders about as if in search of something, but from giddiness or great muscular weakness he is soon unable to walk or even to stand; he talks incoherently, laughs wildly, moves about as if to avoid spectra, and picks or catches incessantly at real or imaginary objects. He appears as if drawing out imaginary threads from the ends of his fingers, and his antics are of the most varied and ludicrous kind. The pupils are invariably dilated, and the spectra are illusions depending on disordered vision. Distant objects appear near to him, and near objects as if highly magnified: he will attempt to grasp a distant object as if it were close at hand, and will start back on a person approaching, as if he thought the person was quite near to him. In the second stage of poisoning, there is either great drowsiness or complete stupor, sometimes passing into utter insensibility, with stertorous breathing. The third stage of final delirium is similar to the first. (Op. cit. p. 593.) I am indebted to Dr. Irving, of Allahabad, for some additional information respecting the employment of datura by the professional poisoners of India. ('Cases of Food-Poisoning,' &c., 1864.) The effects are generally produced within a quarter of an hour, and those who have taken the poisoned food have had little or no recollection of anything that occurred afterwards. An extract of datura is probably used as one of the methods of 'hocussing' persons by thieves in this country. The dilatation of the pupil, with the peculiar train of symptoms, above described would distinguish this state from ordinary intoxication. The bitter taste of the liquid might excite suspicion; but if the person is already partially intoxicated, he may be incapable of making any observation of this kind.

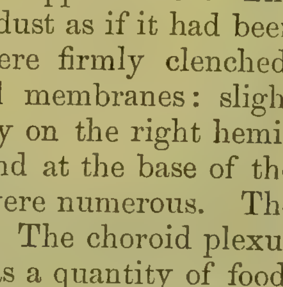
Appearances.—In a well-marked case of poisoning by stramonium-seeds, in which death took place in less than eight hours, Mr. Allan found the following appearances: great congestion of the vessels of the brain and its membranes, the brain firm and highly injected, choroid plexus turgid, ventricles containing serum, substance of the lungs congested, and the heart flaccid. The stomach contained about four ounces of digested food mixed with eighty-nine seeds of stramonium. There were two patches of extravasation in the mucous coat — one on the larger curvature, and the other near the pylorus. Many seeds and fragments were also found in the intestines. ('Lancet,' Sept. 18, 1847, p. 298.) In the Osnabrück case there were marks of diffused inflammation about the cardiac end of the stomach.

Dr. Irving describes the appearances met with in the body of one of the professional Indian poisoners, Bassawur Singh, who, in order to lull suspicion, partook of the poisoned food himself. His intended victims became insensible: he robbed them and left them to their fate. After a time they recovered their senses and gave information at the police station. The poisoner was found under a tree, about a mile from the place, quite insensible. Remedies were unsuccessfully used, and he died shortly after being apprehended. On his person was found all the stolen property, besides a quantity of datura seeds. The following were the post-mortem appearances: The pupils were widely dilated: the body was covered with dust as if it had been rolled on the ground. The fingers of both hands were firmly clenched. There was great venous congestion of the brain and membranes: slight effusion of bloody serum under the membranes, chiefly on the right hemisphere. About an ounce of dark fluid blood was found at the base of the skull. The bloody points on a section of the brain were numerous. The ventricles contained a considerable quantity of serum. The choroid plexus was unusually full of blood. In the stomach there was a quantity of food, partially digested, in which were found seeds of datura as well as seeds of the *Solanum Melongena*, which in form they somewhat resembled. ('Cases of Food Poisoning,' &c., 1864. 'Indian Annals of Medical Science,' No. 17.)

Analysis.—The *seeds* of stramonium, from which accidents have most fre-uently occurred, are flattened, kidney-shaped, but half oval, rough, and of a ark-brown or black colour. The seeds are liable to be mistaken for those of apsicum. Dr. Brown thus describes the difference:—'The datura seeds present ots on their exterior, which on microscopical examination are een to be composed of convo- ited ridges surrounding spaces. n the capsicum seed these con-oluted ridges run nearly paral-l to each other, and are joined right angles by shorter ridges, that most of the spaces are of oblong form, and are as lines rving round the seed: but in tura, the ridges are more con-luted and irregular, joining at acute angles and circumscribing irregular aces.' ('Poisons of the Punjab,' 1863, p. 67.) Of the dry datura stramo-um, there are about eight seeds to a grain. They are of an oblong kidney-ape, and of a dark-brown or black colour. The seeds of the datura fastuosa, ceived from Dr. Brown of Lahore, are so similar in size and general appear-ce that a separate illustration of them is quite unnecessary. The seeds of tura alba, also received from Dr. Brown, are larger, flatter, and much hter coloured, but have similar microscopical characters. These are the ds which are chiefly used by the Thugs, and the poisoning robbers of lia.



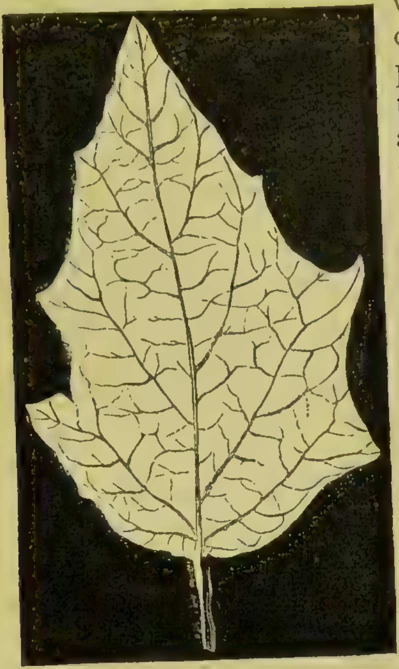
Seeds of Datura Stramonium.
a. Natural size.
b. Magnified 30 diameters.

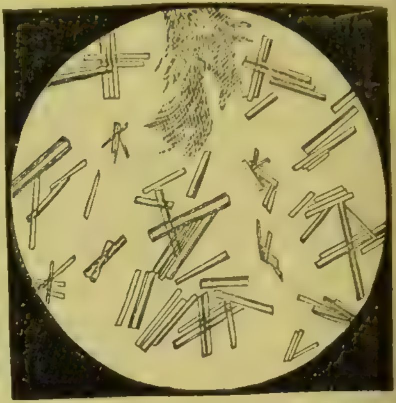


Seeds of Datura alba (India).
a. Natural size.
b. Slightly magnified by a lens.

The *leaves* of the common datura stramonium are well characterized by ir peculiar shape. In the annexed illustration is represented a small leaf the datura stramonium from a young plant. In the full-grown plant the ves retain the same characters, but are much larger. (See illustration at 370.)

DATURIA.—The poisonous properties of thornapple are owing to the presence of an alkaloid, *daturia*, which forms about one per cent. of the dried vegetable. For a comparison of its properties with those of Atropia and Hyoscyamia which it resembles, see Bouchardat, 'Ann. de Thérapeutique,' 1864, p. 24. This alkaloid crystallizes in long colourless prisms or needles; it has a bitter taste, somewhat acrid, and slightly resembling that of tobacco. It is poisonous. The eighth of a grain killed a sparrow in three hours. When placed on the eye or introduced into the cellular membrane of an animal, it is observed, like atropia, to cause dilatation of the pupil. When heated in a tube it is decomposed, and ammonia is evolved as with other alkaloids. It is soluble in water, and the solution has an alkaline reaction. It is precipitated by *tannic* acid and by the chloriodide of potassium and mercury. Nitric and hydrochloric acids dissolve it, without producing any change of colour. Sulphuric acid produces a pale rose-red colour with the crystals, which becomes paler when the acid mixture is diluted with water.


Small leaf of Stramonium from a photograph : natural size.


Crystals of Daturia, magnified 30 diameters.

LABURNUM. (CYTISUS LABURNUM.)

Symptoms and Effects.—The bark and seeds of the common LABURNUM contain an active poison called *Cytisine*. A case of poisoning by the *bark*, which was the subject of a trial at Inverness, has been reported by Dr. Christison. ('Ed. Med. and S. J.' Oct. 1843.) A youth, with the intention of merely producing vomiting in one of his fellow-servants, a female, put some dry laburnum bark into the broth which was being prepared for their dinner. The cook, who remarked a 'strong peculiar taste' in the broth, soon became very ill, and in five minutes was attacked with violent vomiting. The account of the symptoms is imperfect; for the cause of them was not even suspected until six months afterwards. The vomiting continued thirty-six hours; was accompanied by shivering,—pain in the abdomen, especially in the stomach,—and great feebleness, with severe purging. These symptoms continued, more or less, for a period of eight months; and the woman fell off in flesh and strength. At this period she was seen by a physician, who had been called on by the law authorities to investigate the case. She was then suffering from gastro-intestinal irritation, vomiting after food, pain in the abdomen, increased by pressure, purging, tenesmus and bloody evacuations, with other serious symptoms. The medical opinion was that she was then in a highly dangerous state. The woman did not eventually recover until the following April. There was no doubt, from the investigation made by Dr. Ross and Dr. Christison, that her protracted illness was really due to the effects of laburnum-bark.

In reference to poisoning by the *seeds* of laburnum there are but few instances recorded. Dr. Traill has described two cases, and Mr. Rake, a former pupil, has communicated to me a case of poisoning by the pods and seeds which occurred in September 1851. Two children, the one aged two, and the other three years, had been seen playing together, and on returning home they appeared unwell, and soon afterwards vomited. They had been seen with laburnum pods in their hands, and some seeds with portions of the pods were mixed with the vomited matter. Both children were pale and exhausted, with a slow and somewhat feeble pulse. The pupils were natural. An emetic was given, but no more seeds were ejected: the pulse increased in volume and frequency, and the next day the children had recovered their usual health. In October 1856, twelve children, at Otley in Yorkshire, were attacked with rigidity of the limbs and other symptoms of poisoning in consequence of having swallowed these seeds. They recovered under the use of emetics. ('Lancet,' Nov. 1, 1856, p. 497.)

In September 1862, two boys swallowed a quantity of laburnum seeds in a cake. In about three-quarters of an hour one was seized with vomiting and purging,—pulse weak and frequent,—severe rigors,—muscular twitchings in the face and neck, and great epigastric pain. The pupils were dilated, but there was no headache. Many seeds were vomited. There was a great disposition to sleep, and coldness of the skin. Under treatment they recovered. ('Pharm. Journal,' Oct. 1862, p. 185.) In September 1863, a girl, æt. nine, died at Worcester in consequence of having eaten a few of the seeds. The late Mr. Barber, of Stamford, communicated to me, in June 1848, the particulars of a case which shows that even the *flowers* of this plant are highly noxious. A child between three and four years of age ate twelve laburnum flowers, and in about fifteen minutes it complained of sickness and severe pain in the stomach. The child vomited a quantity of mucus mixed with the yellow petals of the laburnum. An emetic was given: this cleared the stomach, and the child recovered. There was no purging. ('Guy's Hosp. Reports,' Oct. 1850, p. 219.) A case in which a child suffered from symptoms of a nervous kind by reason of its having eaten laburnum flowers, is described by Mr. North in the 'Medical and Physical Journal,' vol. 62, page 86.

Analysis.—The poisonous principle of the laburnum is called *Cytisine.* It is difficult of separation, and at present has no well-defined chemical properties whereby it may be identified. Hence, when administered in powder, infusion, or decoction, there are no chemical processes known by which the poison may be detected. A decoction of the bark forms a clear light brown liquid, having an acid reaction. It strikes a dark olive-green colour with a persalt of iron. Nitric acid renders it lighter. Acetate of lead precipitates it, but the precipitate has none of the properties of meconate of lead. The *leaves* of the laburnum are well known. An illustration of a leaf of its natural size, which is copied from a photograph, is annexed. The *seeds* are somewhat kidney-shaped, slightly hooked at the hilum. They shrink in drying, become dark-coloured, and present irregular depressions on the surface. They have no markings, and are thus easily distinguished from most other poisonous seeds. They are larger than those of datura stramonium.

Seeds of Laburnum.
a. Natural size.
b. Slightly magnified by a lens.

Leaf of Laburnum: natural size.

Cytisine is said to be the poison contained in the leaves of an Insect Powder, which is known by the name of Australian or Persian Insect Powder.

YEW. (TAXUS BACCATA.)

Symptoms and Effects.—It has been long known that the berries and leaves of the yew-tree are poisonous to cattle; they act very energetically, and produce death in a few hours, sometimes without vomiting or purging. It is stated by Dr. Percival that a tablespoonful of the *fresh leaves* was administered to three children of five, four, and three years of age as a vermifuge. Yawning and listlessness soon succeeded: the eldest vomited a little, and complained of pain in the abdomen, but the other two suffered no pain. They all died within a few hours of each other. A case of poisoning by the *berries* of this tree was published a few years since by Mr. Hurt, of Mansfield. A child aged three years and a half, ate a quantity of yew-berries about eleven o'clock. In an hour afterwards the child appeared ill, but did not complain of any pain. It vomited part of its dinner, mixed with some of the berries. A medical man was sent for, but the child died in convulsions before he arrived. On inspection, the stomach was found filled with mucus, and the half-digested pulp of the berries and seeds. There were patches of redness in the mucous membrane, and this was so much softened that it could be detached with the slightest friction. The small intestines were also inflamed.

In March 1845, a case was reported to the Dublin Pathological Society by Dr. Mollan, in which a lunatic had died from the effects produced by *yew-leaves.* The deceased was observed chewing the plant, probably from that perversion of appetite so commonly observed in insanity, and before the attendants had taken it from him, he had succeeded in swallowing a portion of the masticated juice. He was soon afterwards seized with giddiness, sudden prostration of strength, vomiting, coldness of the surface, spasms, and irregular action of the heart. He died in fourteen hours. On inspection, the stomach was found much distended,—it contained some yew-leaves. There was emphysema in the submucous tissue, but no other abnormal change: there was some thickening with opacity of the arachnoid, which might have been due to the insanity. ('Dub. Hosp. Gaz.,' May 15, 1845, p. 109.)

There is no doubt that the yew is a cerebro-spinal poison. The symptoms produced by the *leaves* and berries are pretty uniform in character: convulsions, insensibility, coma, dilated pupils, pale countenance, small pulse, and cold extremities, are the most prominent. Vomiting and purging are also observed among the symptoms. In two cases, the subject of one—a girl about five years of age,—died in a comatose state in four hours after she had eaten the *berries*, and the other, a boy, æt. 4 years, died nineteen days after taking the berries, obviously from severe inflammation of the bowels. The immediate symptoms in the boy were vomiting, purging, coma, convulsions, dilated pupils, hurried respiration, a small pulse, and a cold skin. (See 'Prov. Jour.,' Nov. 29, 1848, p. 662, and Dec. 27, p. 708.)

There is a vulgar but erroneous notion that the yew-leaves are not poisonous when fresh, and that in any case they act only mechanically. A case related above shows the fallacy of the opinion, and the other cases prove that there is a specific poison in the yew, since it exists in the berries as well as in the leaves. If cattle recover from the primary effects on the nervous system, they are liable to die, after several days, from inflammation of the bowels. On one occasion I examined the viscera of an ox which had obviously died from the effects of yew-leaves. In some parts of the intestines gangrene had taken place.

The nature of the poisonous principle is unknown, and it is not certain whether, with respect to the berry, the poison is lodged in the pulp or the seed, although it is most probably in the latter. *Infusion* of yew-leaves, which is popularly called yew-tree tea, is sometimes used for the purpose of procuring abortion by ignorant midwives. A case of death from a person drinking this infusion is reported in the registration returns for 1838-9. In the returns for 1840, there is also one death of a female, æt. 34, referred to her having eaten the berries of the yew. The subject of poisoning by yew-leaves, in reference to their employment for purposes of abortion, has been investigated by MM. Chevallier, Duchesne, and Reynal. (See 'Ann. d'Hyg.' 1855, vol. 2, pp. 94 and 335.)

Yew-leaves and fragments: natural size.

Analysis.—The leaves or berries may be found in the stomach. The yew and the savin are the only coniferous poisons which grow in this country. The apex of the leaf of the yew is not so pointed as that of the savin, and the yew-leaf does not possess the peculiar odour of savin when rubbed. In the annexed illustration the leaf is of *the natural* size, the engraving having been made from a photograph of the living leaf. Yew-berries are seen in autumn; they are about the size of a pea, of a light red colour, dull on the surface, and translucent. They are open at the top, allowing a hard brown kernel to be seen. This is of an ovoid shape, and it forms the greater part of the berry. The fine red skin contains a colourless and remarkably viscid or adhesive juice, which reddens litmus paper, and has a nauseous sweetish taste.

PRIVET. (LIGUSTRUM VULGARE.)

The privet is not commonly enumerated among vegetable poisons. No reference is made to this plant in the works of Wibmer, Orfila, Christison, and other writers on toxicology, and yet it would appear, from the subjoined cases for the brief particulars of which I am indebted to Mr. Ward, of Ollerton, that the *berries* may exert a poisonous action. In December 1853, three children ate the berries of the privet; two of them, a boy of three years of age and a girl of six, eating them rather freely. They suffered from violent purging, and when seen by a medical man the little boy was found pulseless, cold, and before death was frequently and violently convulsed. The girl was in a state of collapse, but rallied a little under treatment: she soon afterwards died convulsed. The surviving child, who had only tasted the berries, did not suffer, and she was enabled to point out the shrub, the berries of which they had gathered. So far as I know, these are the only cases on record in which the berries of the privet have proved fatal. According to Loudon, they are eaten by birds when other sources of food fail.

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WOUNDS AND PERSONAL INJURIES.

CHAPTER 31.

SURGICAL DEFINITIONS OF A WOUND—INJURY TO THE SKIN—LEGAL DEFINITION—IMPLIES IMMEDIATE AND NOT REMOTE INJURY TO THE SKIN—IS A DISLOCATION OR FRACTURE A WOUND?—WOUNDS DANGEROUS TO LIFE—THE DANGER IMMINENT—WOUNDS PRODUCING GRIEVOUS BODILY HARM.

When a person is the subject of a wound or external injury, from the effects of which he ultimately recovers, a medical witness is often rigorously examined with respect to the precise nature of the injury, and how far it involved a risk of life. The answers to these questions may have an important influence on the defence of a prisoner, when the crime is charged under particular forms of indictment.

Definition of a Wound.—It may be safely asserted, that we shall look in vain for any consistent definition of a wound, in works on medicine and surgery. A wound is perhaps most commonly defined to be a 'recent solution of continuity in the soft parts, suddenly occasioned by external causes.' Yet they who adopt this view do not regard as wounds ruptures of the liver or spleen, burns by heated bodies, or simple dislocations and fractures, although these injuries are strictly comprehended in such a definition. The following definitions of a wound were furnished to me some years since by three eminent surgeons of this metropolis, now deceased.

'A solution of continuity from violence of any naturally continuous parts.'

'An external breach of continuity directly occasioned by violence.'

'An injury to an organic texture by mechanical or other violence.'

Owing to the unsettled meaning of the word *wound*, it has happened on more than one occasion, that medical witnesses have differed in their evidence; and some difficulty has arisen in the prosecution of criminal charges. It has been asserted that, in order to constitute a wound, the *skin* should always be *broken* or injured; and this, as we shall see presently, is the interpretation commonly put upon the term by our judges. But the advocates of this definition do not regard *burns*, produced either by heated metals or corrosive liquids, as wounds, although the skin may be broken or destroyed. Technical difficulties of this kind, which only lead to the embarrassment of witnesses and to the acquittal of prisoners charged with serious offences, might be avoided if the medical witnesses of England were allowed to adopt the comprehensive definition sanctioned by the legal tribunals of certain States on the Continent, namely, that 'a wound includes any personal injury, suddenly arising from any kind of violence applied externally, whether such injury is external or internal.' It may appear contrary to surgical propriety to designate a burn, contusion or fracture as a wound; but the common surgical definitions will be found, on examination, to be utterly inconsistent, and to be attended in legal medicine by evil results, inasmuch as they lead to acquittals, not upon the merits of a case, but upon the most trivial pretences. This could not happen if the above comprehensive definition were generally adopted. The late Lord Justice Clerk Hope informed me that this is the legal signification of a wound in the law of Scotland, and that no injustice has been done or inconvenience occasioned to the prosecution or defence by this general and rational sense of the term.

On these occasions and in reference to medical evidence, we are bound to regard the wants of justice rather than the strict rules of surgery. If medico-legal cases fail from differences respecting the meaning of scientific terms among surgical writers, it is time that some fixed rule should be adopted. While the practice of surgery cannot possibly suffer by such an innovation, the administration of the law will be rendered more efficient. The statute, 14 and 15 Vict. c. 100, has, however, supplied a remedy for some of the evils which have hitherto arisen from a misdescription of personal injuries in indictments.

Legal definition.—It cannot be denied that an alteration in the use of medical terms must, in order to be attended with any good effects, receive the support of our legal authorities. This, probably, would not be long withheld, if good reasons for the change were afforded by medical witnesses. Some learned judges have held that no injury constitutes a wound in law, unless the continuity of the skin is broken; so that in a case in which blows were nflicted with a hammer or iron instrument sufficient to break the collar-bone, and violently bruise but not break the skin, it was held not to be a wounding within the statute. (*Reg.* v. *Wood*, 'Matthew's Digest,' p. 415.) The Act 1 Vict. c. 85, provided for the punishment of persons guilty of inflicting such severe injuries, but left the legal signification of the word wound unsettled. The 14 and 15 Vict. c. 100, is more precise, but this also avoids any legal definition of a wound.

In order to remove any difficulty in future cases, and to put an end to conflicting decisions, the Commissioners for codifying the Criminal Law suggested that *internal* breaches of continuity should be included under the erm wound. They have defined a wound to be '*that whereby the skin is divided either externally or internally.*' The late Mr. Justice Talfourd objected to this definition, because, in his opinion, the division of the skin nternally without a division externally was impossible. The use of the word skin' leads to ambiguity; and, in this instance, it shows that those who frame aws are not sufficiently careful in the selection of professional terms. The kin consists of the cuticle and cutis. It has been held on more than one ccasion that an abrasion of the *cuticle*, or outer skin only, is not a wound. A man was tried at the Central Criminal Court in August, 1838, n a charge of cutting and wounding the prosecutor. The prisoner struck he prosecutor a severe blow on the temple with a heavy stone bottle, which as thereby broken in pieces. The prosecutor fell senseless, and it was a ong time before he recovered from the effects of the violence. The medical itnesses in this case underwent a rigorous cross-examination by the risoner's counsel, respecting the meaning of the word 'wound.' They aid that there had been a separation of the *cuticle* or outer skin of the tem-le, but not of the cutis, and that there was no absolute wound in the usual ceptation of the word. They further deposed that the prosecutor had lost he sight of his left eye, and the hearing of his left ear; and he was for a onsiderable time in a state of great danger, from which he had scarcely re-overed. The prisoner's counsel contended that the injuries were not such s to constitute cutting and *wounding* in law. The judges said, that in order hat a wound, in contemplation of law, should have been inflicted, it was ecessary that the *whole skin*, and not the mere *cuticle*, should have been eparated and divided; and as the evidence did not show distinctly that there was such a wound, those counts of the indictment could not be sustained. The prisoner was found guilty of an assault. A division of the *cutis* or true skin has always been regarded as a wound, whether blood is effused or not. The boundary of the cutis towards the inside of the body is not easily determined; since there is a gradual transition of the cutis into the subjacent fibrous tissue, in which the fat and sudatory glands are contained. According to Quain and Sharpey ('Elements of Anatomy,' vol. 1, p. 285), the cutis measures in thickness from a quarter of a line to a line and a half (a line being about one-twelfth of an inch). It is thicker in some parts than in others. Taking the true skin, or cutis, at the thickness usually assigned, it is impossible to conceive that such a very thin layer of membrane as this can be divided internally without an external division being produced. Allowing the maximum thickness of the eighth of an inch, it would be difficult for any medical man to affirm that only a fractional part of this membrane had been divided internally, when there was no evidence of external separation; and it would be certainly impossible for him to prove it. What the Commissioners probably mean, is a division of the structures beneath the skin. Their definition is, however, vague and unsatisfactory, because it does not reach an important class of cases in which wounds are inflicted not in the skin, but in the mucous membrane lining the outlets of the body. Thus cuts, punctures, or lacerations of the lining membrane of the nostrils, mouth, and throat, rectum and vagina, are undoubtedly wounds, although the skin may not be directly touched by the weapon. Injuries of a serious description have thus been frequently inflicted on females by cutting and pointed instruments: they have been hitherto properly treated as wounds, but they would not be comprised under this term by a strict adherence to the proposed definition. Skin and mucous membrane are not regarded by physiologists as one and the same structure. It is, however, satisfactory to find that there is at least one legal case on record, in which injuries to the mucous membrane, not involving the external skin, have been judicially pronounced to be wounds. In Scotland, so far as I know, the matter has never been contested. In the subjoined case the prisoner was charged with maliciously *wounding* a mare. He had thrust forcibly down the throat of the animal a stone, which had torn the throat and gullet. It was objected that the injury was not a wounding within the statute, the parts injured being *internal*, and there being no proof of any external blow or violence. The judge who tried the case was of opinion that it fell within the statute. Blood had flowed from the broken skin or membrane lining the throat, and the stone was forced into the flesh; and it had been held that the injury need not be 'external' to bring the case within the statute. The prisoner was convicted. (*Reg.* v. *Bolton*, Norwich Summer Assizes, 1849.) Under this head would fall injuries to the brain produced by pointed instruments passed up the nostrils through the ethmoid bone. Other cases, in which the vagina in females has been thus wounded are given under the section of 'Wounds of the Genital Organs.' (See case, post, p. 386.)

Do all breaches of continuity involving the skin or mucous membrane, fall under the head of wounds? Burns appear to constitute an exception; but there is no reason why a burn producing a destruction of the skin, as by a red-hot poker, should not be regarded and treated in law as a wound. No definition of a wound, medically or legally, can be so contrived as to exclude such an injury. The question, however, mainly to be considered is this—May not a breach of continuity be regarded as a wound, although neither the skin nor the mucous membrane is directly implicated in the injury? Is a simple dislocation or fracture a wound? Is a rupture of the bladder, liver, or other organ, suddenly caused by external violence without implicating the skin, to be regarded as a wound? Is a compound dislocation or fracture a wound?

No definition yet constructed has excluded these last-mentioned injuries, because he skin is always involved. In a case before the Queen's Bench in November, 1847, it was even held that a simple dislocation was a wound. An action was brought against a medical practitioner for negligence in the treatment of a dislo-ation of the arm, and a verdict was returned for the plaintiff. An application was made to the Court for a new trial, on the ground of a misdirection of the Chief Baron, who tried the case. The declaration alleged that the plaintiff had employed the defendant, who was a surgeon, for the treatment and cure of certain *wounds, fractures, bruises, complaints, and disorders*; but the evi-dence showed that the defendant had been employed to cure the plaintiff of a *dislocated arm.* At the close of the plaintiff's case, it was submitted that here was no word in the declaration which was applicable to the case: but his objection was overruled. A dislocation, it was argued, was neither a wound, bruise, nor fracture; and the words 'complaint and disorder' were ot at all applicable to a surgical case, but to internal complaints which re-uire to be treated medically. Lord Denman, in delivering the judgment of he Court, said, 'It is rather strange that the pleader should have omitted the most appropriate word; but we think the Chief Baron was quite right.—Rule efused.' In reference to simple *fractures*, it was held in *Rex* v. *Wood* ('4 C. and .,' p. 381), that a fracture of the collar-bone was not a wounding within he statute, because the *skin* was not broken. There are, however, more ecent cases in which conflicting decisions have been given. The first of these *Reg.* v. *Smith* ('8 C. and P.,' 173.) In this case prisoner struck prosecutor ith an iron hammer on the side of the face. A surgeon from the London Hospital deposed that the lower jaw was broken in two places; that the *skin* as broken *internally* but *not externally*. There was not a great deal of blood ffused. On the objection being taken that this was a fracture and not a wound ithin the statute, Denman, C. J., observed, 'If it is the immediate effect of he injury, we think we cannot distinguish this from the cases already decided;' nd Parke, J. (in summing up), said, 'We were of opinion that there was a wound, and upon consideration, I am more strongly of that opinion than I was the outset. There must be a wounding; but if there be a wound (whether here be an effusion of blood or not), it is within the statute whether the wound internal or external.' The same point arose in another case. (*Reg.* v. *War-an*, '1 Denison, C. C.' 183.) This was an indictment for inflicting a mortal *ound*; and a question arose whether it was supported by proof of a blow hich caused an internal breach of the skin (although externally there were ly the appearances of a bruise). The death of the deceased had been caused a single blow on the head by a piece of wood; and the medical witness scribed the injury as follows: 'I found on examining the head no *external* each of the skin. I found a collection of blood in the back part of the head: e deceased died from effusion of blood, which pressed on the brain. On ex-mining the scalp, I found a collection of blood between the scalp and cranium, st above the spot where, within the cranium, I had found the pressure on e brain. I call that a contused wound with effusion of blood; that is the me thing as a bruise. The internal part of the skin was broken. Medically, e call the breaking of the skin, whether broken externally or internally, a ound.' This case was reserved for the judges, and considered by Denman, ndal, Pollock, Alderson, Williams, Creswell, Parke, Coltman, Wightman, tteson, Erle, and Platt. All thought that this *internal wound* was a suffi-nt wound to support the allegation in the indictment.

In each of these cases the Court appears to have been misled by the medical tnesses affirming that the skin (cutis) was broken internally but not exter-lly. There is no doubt that they intended by this, not the cutis merely, but e areolar fatty tissue and soft parts beneath. Their evidence has, however, served to mislead the Commissioners, and to induce them to propose a faulty and erroneous definition. I know no instance in which a rupture of the bladder or liver, without any external injury, has been called a wound, although this term might be applied with as much propriety to this kind of injury as to a simple fracture or dislocation. The brain is sometimes lacerated by a blow on the skull which does not break the scalp or the skin of the head. This must, however, be regarded as a wound of the brain; it admits of no other description. Two of the definitions given ante, p. 374, include all injuries of this kind. Archbold describes a wounding to be where 'the violence is so great as to draw blood by striking or stabbing with a sword, knife, or other instrument, or by shooting or striking with a cudgel, the fist, or the like;' while 'a wound includes incised, punctured, lacerated, contused, or gun-shot wounds.' ('Pleading and Evidence in Criminal Cases,' 15th edition, by Welsby, 1862, pp. 567, 572.) In the first part of this quotation, the 'drawing of blood' is made a character of a wound. This is inconsistent with the further statement respecting lacerated, contused, and gun-shot wounds, for these injuries are not necessarily accompanied with the effusion of blood: and in some of the most fatal wounds of this class no blood is effused. It appears to me that the best definition which we can at present give to the word 'wound,' whether in a medical or legal sense, is that it implies 'a breach of continuity in the structures of the body, whether external or internal, suddenly occasioned by mechanical violence.' This would include injuries to the skin or mucous membrane, dislocations and fractures, whether simple or compound, and ruptures of the viscera.

Wounds dangerous to life.—A medical witness is sometimes asked, whether a wound is or is not dangerous to life. In reference to persons charged with an attempt to murder or maim, a written medical opinion, or a deposition, may be demanded of a surgeon by a magistrate, in order to justify the detention of prisoners. The meaning of the words, '*dangerous to life*,' is left entirely to the professional knowledge of a witness. It is not sufficient on these occasions that he should make a naked declaration of the wound being dangerous to life; he must, if called upon, state to the Court satisfactory reasons for this opinion; and these reasons are rigorously inquired into by counsel for the defence. As a general principle it would not be proper to consider those wounds dangerous to life, in which the danger is not *imminent*. A wound of a great blood-vessel, of any of the viscera, or a compound fracture with depression of the bones of the head, must in all instances be regarded as bodily injuries dangerous to life; because in such cases the danger is imminent. Unless timely assistance be rendered, these injuries will most probably prove fatal, and, indeed, they often destroy life in spite of the best surgical treatment. When, however, the danger is remote, as in a puncture or laceration of the hand or foot, which may be followed by tetanus, or in a laceration of the scalp, which may be followed by erysipelas, or in penetrating wounds of the orbit, which may be attended by fatal inflammation of the brain or its membranes, the case is somewhat different. Such injuries as these are not directly dangerous to life—they are only liable to be attended with danger in certain cases, and under certain circumstances; hence the medical opinion must be qualified. The law, on these occasions, appears to contemplate the direct and not the future or possible occurrence of danger; if the last view were adopted, it is clear that the most trivial lacerations and punctures might be pronounced dangerous to life; since tetanus or erysipelas proving fatal, has been an occasional consequence of very slight injuries. A difference of opinion will often exist among medical witnesses, whether a particular wound is or is not dangerous to life. Unanimity can only be expected when the judgment and experience of the witnesses are equal. The rules for forming an opinion in these cases, will, perhaps, be best deduced

om the results of the observations of good surgical authorities in relation to
juries of different parts of the body. This will form a subject for considera-
on hereafter.

Dying declarations.—The wound may be of such a nature as to cause death
eedily, so that a practitioner may arrive only in time to see the wounded
rson die. In this case, the dying person may make a declaration or state-
ent as to the circumstances under which the wound was inflicted: he may
so mention the names of the parties by whom he was assaulted. This *dying*
claration or statement, according to the circumstances under which it is made,
ay become of material importance in the prosecution of a party charged with
micide. It is therefore proper that a practitioner should observe and make
tes of the *exact condition* of the dying person: whether, at the time he makes
e statement, he is under the conviction that he must die, either expressed in
nguage or implied by his conduct. According to some authorities, it is not
cessary that a man should declare that he believes himself to be dying, in
der to render his statement admissible; but he must, at the time of making
be under the full conviction of approaching death. The question respecting
e admissibility of a dying declaration was argued in the Court of Exchequer,
nuary, 1845, in *Reg.* v. *Howell*, when Alderson, B., said it was not necessary
at the deceased should be *in articulo mortis*, or even that he should *think* so.
is enough if he thinks he shall die of the sickness under which he labours.
Law Times,' Jan. 25, 1845, p. 317.) When it is made clear to the Court,
medical or other testimony, that all hope of life was lost, the statement will
received as evidence against an accused person; for the law supposes, that
the act of dying, all interest in this world is taken away, and that the near
ntemplation of death has the same powerful effect upon the mind, as the
lemn obligation of an oath. It is presumed that there can be no disposition
the part of a dying person to wilfully misrepresent facts, or to state what is
se. Much, therefore, often depends on the conduct of a medical practitioner
der such circumstances, for the usual method of testing the truth of a state-
ent by cross-examination is, of course, out of the question: it must, if ad-
tted at all, be received as it was made.

It was formerly believed, that if the person at the time of making the
tement had still some *hope of recovery*, it would not be legally admissible.
is question was raised in *Mr. Seton's* case (*Reg.* v. *Pym*, Hants Lent Ass.,
46). The deceased had been told by his medical attendant, Dr. Stewart,
at there was 'not the least hope of recovery.' He then made a statement,
d two or three hours *after*, he asked the surgeon whether he thought he
s better; but his (the witness's) conviction was that he then believed that
immediate death was approaching. Counsel for the prisoner objected that
s declaration was not admissible. It plainly appeared, from the question
t by the deceased, that he had nct given up all hope of recovery, but that
still thought he might recover. (*Christie's* case, 2 'Russ. on Crimes,' 754;
nner's case, *ib.* 759; and 6 'Car. and P.,' 386; *Fagent's* case, 7 'Car. and P.'
8.) 'Erle, J.: I think the evidence is admissible. The principle is that
erson who speaks with the conviction that his death is fast approaching,
aks under such a sense of responsibility, that the law presumes that he
l tell the truth. Here Mr. Seton had a firm belief that his death was
t approaching. Upon the answer of the surgeon, he burst into tears, and
nked the medical men for their exertions. It has, no doubt, been held in
ne cases that *all hope* must be given up, but this is now decided not to be
essary. Indeed, if it were so, no declarations could be received, for
rcely a human being could be found, in any circumstances, who would not
ain some hope. *The law admits these declarations, not because recovery*
impossible, but because there is the conviction of approaching death. Mr.

Seton was shown to be in this state; the evidence is admissible. The statement was then received.' ('Law Times,' March 21, 1846, p. 500.) It is not, therefore, necessary, to render the declaration valid, that the person making it must entertain 'no hope of recovery.' At the Special Commission in Ireland (Jan. 1848, *Reg.* v. *Butler*), a declaration was admitted where the words were, that the deceased entertained 'little or no hope' of recovery. In *Reg.* v. *Bayley* ('Exchequer Chamber,' Jan. 1857), in which it appeared that the surgeon had given some hope to the dying person before the declaration was made, while the declarant stated that he did not himself believe that he could recover ultimately, its reception was objected to on the part of the prisoners because the surgeon had given the man some hope. He died two days afterwards. Pollock, C. B., ruled that the real belief of the dying man was the question, and here he had said, notwithstanding the opinion of the surgeon, he believed he could not recover. In the case of *Reg.* v. *Harvey* (Exeter Summer Assizes, 1854), the chief evidence against the prisoner consisted of certain statements made by the deceased. They were admitted by Wightman, J., because it appeared clearly from the evidence that when they were made, deceased had expressed an opinion that she should die shortly, and had not changed that opinion. Her whole conduct intimated that she had no hope of recovery. It was observed on this occasion that the medical and other witnesses were more desirous of telling the deceased her state, than of ascertaining what her own opinion was.

It is no part of the duty of a medical witness to form a judgment on this important subject. He should give the statement as it was made, and leave the Court to decide upon its admissibility from the circumstances carefully observed by him with respect to the condition of the patient. He should not render himself officious in extracting information. He should receive that which is *voluntarily uttered*, and, either immediately or on the earliest possible opportunity, write down the statement in the *identical* words, carefully avoiding his own interpretation or any paraphrase of them. On no account should leading questions be put — and any question should be simply confined to the purpose of explaining what may appear ambiguous or contradictory in the declaration itself. It is well known that when death takes place from violence, especially when this proceeds from loss of blood or a wound of the head, delirium is apt to supervene, or the intellect of the dying person becomes confused. Under these circumstances, great caution should be used in receiving a declaration, since it may lead to the implication of innocent persons. It is also proper to remark, that the identity of a person is, under these circumstances, liable to be mistaken; and that it is in general an injudicious proceeding to take a suspected party before one who is dying, in order that he may be identified. A fatal mistake of this kind was made many years since in London. A woman was maltreated by some men on Kennington Common. She was taken to St. Thomas's Hospital, and while dying from the effects of the violence, a suspected party was brought before her, as one of the supposed assailants. She stated that he was one of those who had assaulted her. The man was tried, upon her declaration respecting his identity—found guilty and executed; but a year after the execution, his innocence was satisfactorily established by the discovery of the real murderers!

In *Reg.* v. *Qualter* (Stafford Lent Assizes, 1854), the escape of a criminal was attributed to the neglect of the medical attendant in reference to a dying declaration. The deceased was grossly ill-treated, as it was alleged, by the prisoner and others. He lingered from the 19th of June until the 8th of August, 1853, when he died from the injuries received. On his death-bed he made certain statements implicating the prisoner, and upon these, the case for the prosecution chiefly rested. Qualter was tried for the murder. The

ceased told his wife that he knew he should not recover, but as the
claration against Qualter was made previously to this, it was of course
admissible. A similar declaration affecting the prisoner was subsequently
ade by the deceased to the medical attendant; and it seems that this witness
d told the wife that her husband would not recover, but not in the presence
the deceased: hence the declaration made by deceased to him was inad-
issible, and the prisoner was acquitted. There was a want of proof, in fact,
at either declaration had been made by the dying man while he was under
e conviction of approaching death. Had the surgeon announced to the
ceased that he could not recover, or had he made the announcement to the
fe in his presence and hearing, the declaration might have been received.
is certainly advisable, in all cases when a medical man perceives that the
covery of a wounded person is impossible, that he should take the first
portunity of stating his opinion to the wounded man in the presence of
hers, so that the ends of justice may not be defeated by reason of the non-
servance of these legal forms. (See the case of *Reg.* v. *Harvey*, Exeter
mmer Assizes, 1854.)

Wounds causing grievous bodily harm.—A wound may not be dangerous to
e, but it may have produced '*grievous bodily harm.*' This question is
metimes put, although the usual practice is to leave it to be drawn by the
y as an inference from a professional description of the injury. These
rds have a vague signification; but it would perhaps be difficult to
bstitute for them others less open to criticism. They evidently refer to a
nor description of offence, and are applied commonly to those injuries
ich, while they do not actually place life in danger, may be attended with
nsiderable personal inconvenience, or be in some way detrimental to the health
the wounded party. It is always a question for a jury, whether the *intent*
the prisoner, in inflicting a wound, was or was not to produce grievous
lily harm. Sometimes the nature or the situation of a wound, as well as
kind of weapon used, will at once explain the intent: so far the medical
ness may assist the Court, by giving a plain description of the injury, as
ll as of the consequences with which it is usually attended. It may happen
ner that the wound itself is not of a serious nature, and yet the intention of
risoner may have been to do grievous bodily harm to the wounded person,
as in the following case, the injury may be really serious, and yet the
soner may not have intended to do grievous bodily harm. A man was
icted for feloniously wounding a girl, with intent to do grievous bodily harm.
kicked her in the lower part of her abdomen,—the surgeon described the
ury as of the most serious character, and said that at one time he con-
ered the life of the prosecutrix in danger. She was still suffering, and
uld probably feel the effects of the injury for the rest of her life. The
ge, in summing up the case, told the jury that the material question
them to consider was the *intent* of the prisoner. It was not because
ous injury was the result of a prisoner's act, that they were therefore to
r his intention was to do that injury; and they were to judge, from all
circumstances, whether, at the time he kicked the prosecutrix, he intended
o her grievous bodily harm, as was imputed to him by the indictment, or
ther he was merely guilty of a common assault. He was found guilty of
ommon assault. (*Reg.* v. *Haynes*, Central Criminal Court, September
7.) In cases of this description, the intent with which a wound was
cted must be made out by evidence of a non-medical kind. (See also
case of *Reg.* v. *Maslin*, Devizes Summer Assizes, 1838.)

hese are the principal medico-legal questions connected with wounds
n the wounded person is seen while *living*. We will suppose, however,
the wounded person is found dead, and an examination of the body is

required to be made. The most difficult part of the duty of a medical jurist now commences. Among the numerous questions which here present themselves, the first which demands examination, is whether the wound was inflicted on the body before or after death.

CHAPTER 32.

EXAMINATION OF WOUNDS IN THE DEAD BODY—ALL THE CAVITIES SHOULD BE INSPECTED—ACQUITTALS FROM THE NEGLECT OF THIS RULE—CHARACTERS OF A WOUND INFLICTED DURING LIFE—OF A WOUND MADE AFTER DEATH—EXPERIMENTS ON AMPUTATED LIMBS—CAUTION IN MEDICAL OPINIONS—WOUNDS OR INJURIES UNATTENDED WITH BLEEDING—ECCHYMOSIS FROM VIOLENCE—EVIDENCE FROM ECCHYMOSIS—ECCHYMOSIS FROM NATURAL CAUSES—IS ECCHYMOSIS A NECESSARY RESULT OF VIOLENCE?

Examination of Wounds.—In examining a wound on a dead body, it is proper to observe its situation, extent, length, breadth, depth, and direction:—whether there is about it effused blood, either liquid or coagulated, and whether there is ecchymosis, *i. e.* a livid discolouration of the skin from the effused blood. It should also be ascertained whether the surrounding parts are swollen, whether adhesive matter or pus is effused, whether the edges of the wound are gangrenous, or any foreign substances are present in it. Care must be taken that putrefaction is not mistaken for a gangrenous condition of the wound. The wound may be examined by gently introducing into it a bougie, and carrying on the dissection around this instrument, avoiding as much as possible any interference with the external appearances. The preservation of the external form will allow of a comparison being made at any future time between the edges of a wound and a weapon found on a suspected person. Of all these points *notes* should be taken, either on the spot or immediately afterwards. In the dissection, every muscle, vessel, nerve, or organ involved in the injury should be traced and described. This will enable a witness to answer many collateral questions that may unexpectedly arise during the enquiry. Another point should be especially attended to. A medical practitioner has frequently contented himself by confining his dissection to the injured part, thinking that on the trial of an accused party the questions of counsel would be limited to the situation and extent of the wound only, but this is a serious mistake. If the cause of death be at all obscure, on no account should the inspection be abandoned until all the important organs and cavities of the body have been closely examined; since it may be affirmed that a natural cause of death might have existed in that organ or cavity which the medical witness had neglected to examine. (*Reg.* v. *Solloway*, Abingdon Aut. Ass., 1860.) It rests with the practitioner to disprove the probability thus urged by counsel, but he is now destitute of facts on which he can base an opinion,—legal ingenuity will triumph, the witness will be discomfited, and the prisoner, of whose guilt there may be, morally speaking, but little doubt, will have the benefit of his inattention, and be acquitted by the jury.

In the medical reports on the examination of the bodies of wounded persons, care should be taken to avoid the introduction of any remarks in the form of inferences from the facts of the case. At the trial of *McLachlan* (Glasgow Sept. Circuit, 1862), Lord Deas objected to the statements in the medical report, 'that the body of deceased had been found under circumstances of great suspicion,' and 'that there were marks of a severe conflict.' When the witness was cross-examined on the medical facts which had led him to the conclusion that there had been a 'severe conflict,' it resolved self into the statement that there were marks (of blood) on the flags, which ndicated that the body had been dragged along the floor *after death*; but e was unable to mention any medical facts by which this form of expression ould be justified. Inferences of this kind should, as a rule, be entirely xcluded from medical reports.

In making an inspection of the body, the state of the *stomach* should not e overlooked. Death may have been apparently caused by violence, and yet eally be due to poison. Wildberg was called upon to examine the body of girl who had died while her father was chastising her for stealing, apparently rom the effects of the violence. On the arms, shoulders, and back, many arks of violent treatment were found; and under some of them blood was ffused in large quantity. The injuries, although severe, did not, however, ppear sufficient to account for sudden death. He therefore proceeded to examine the cavities, and on opening the stomach, he found it very much nflamed, and lined with a white powder, which was proved to be arsenic. t turned out that on the theft being detected, the girl had taken arsenic for ear of her father's anger: she vomited during the flogging, and died in slight onvulsions. Upon this, Wildberg imputed death to the arsenic, and the man as discharged. Dr. Geoghegan communicated to me a case which occurred n Ireland in 1853, in which a gentleman having taken eleven grains of trychnia, threw himself out of a window, and sustained great bodily injury. he surgeon finding so much more spasm than could be accounted for by the iolence sustained, discovered the real state of the case from the patient's conssion. There was also evidence of the purchase of the poison. The cause f death may be easily assigned in such cases when the circumstances are nown; but it is evident that without proper enquiry and great care in conucting examinations after death, the apparent may be sometimes mistaken r the real cause. (For some interesting cases and good practical suggestions n this subject, see Belloc, 'Cours de Méd. Lég.' 148.) In the summer of 864, an inquest was held at Kilburn on a young man who committed suicide y throwing himself from a window. He lived sufficiently long to inform s medical attendant, Mr. Nelson, that he had first taken corrosive sublimate, then cut open his wrist that he might bleed to death, and finding this infectual, he threw himself from the window. Even when there may be no spicion of poisoning, it will be necessary to observe the state of the stomach d its contents—*i. e.* to determine whether it contains food, the nature of the od, and the degree to which it may have undergone digestion. In *Reg.* v. *icer* (Berks Lent Assizes, 1846), the falsehood of one part of the prisoner's fence was made evident by an examination of the stomach. The deceased as found dead at the foot of a stair. The prisoner stated that *after* he and s wife had had their dinner, he heard a fall. The woman had died instanneously, and the fall was heard by neighbours at or near the dinner-hour. r. Hooper, the medical witness, found the stomach quite empty; there was trace of food. It was therefore clear that this part of the prisoner's story s untrue, as, had the deceased died immediately after dinner, some portion undigested food would have been found.

Description of Wounds.—It is impossible to impress too strongly on the nd of a medical witness, that in describing the wounds which he has found the examination of a body, he should employ plain and simple language, d avoid as much as possible the use of technical or professional terms. e natural desire of a good witness is to make himself understood: but this nnot be accomplished if he clothes his ideas in language which is incomprensible to educated men of the legal profession, and *à fortiori* to the class of n who constitute juries. There are few Assizes which do not afford many ustrations of the injury done to scientific evidence, and the clear understanding of a case, by the technical language in which it is given. A Court may be told that the '*integuments* were *reflected* from the thorax, and the *costal* cartilages laid bare, when a wound was found which had penetrated through the anterior *mediastinum*,' and had involved the arch of the aorta, &c. A simple cut in the skin may be described as 'an incision in the integuments.' On a trial for an assault which took place at the Assizes, some years since, a medical witness, in giving his evidence, informed the Court that on examining the prosecutor, he found him suffering from a severe contusion of the integuments under the left orbit, with great extravasation of blood and ecchymosis in the surrounding cellular tissue, which was in a tumefied state. There was also considerable abrasion of the cuticle. '*Judge*: You mean, I suppose, that the man had a bad black eye. *Witness*: Yes. *Judge*: Then why not say so at once?' It would be easy to multiply examples of this kind: they probably occur more frequently in evidence respecting wounds than in other cases. A medical witness should, for his own credit and for that of the profession to which he belongs, employ plain and simple language in describing a wound, as well as in giving his evidence generally.

Characters of a wound inflicted during life.—If we find about a wound marks of gangrene, the effusion of adhesive or purulent matter, or if the edges are swollen and enlarged, and cicatrization has commenced, it is not only certain that the injury must have been inflicted before death, but that the person must have lived some time after it was inflicted. Marks of this description will not, however, be commonly found when death has taken place within ten or twelve hours from the infliction of the injury. A wound which proves fatal within this period of time will present throughout, much the same characters. Thus, supposing it to have been *incised*, there will be traces of more or less bleeding, the blood having chiefly an arterial character, and it will be found coagulated where it has fallen on surrounding bodies. The edges of the wound are everted, and the muscular and cellular tissue around is deeply reddened by effused blood. Coagula or clots are found adhering to the wound, provided it has not been interfered with. The principal characters of a wound inflicted during life are, then, the following: 1. Eversion of the edges owing to vital elasticity of the skin. 2. Abundant hæmorrhage or bleeding, often of an arterial character, with general diffusion of blood in the surrounding parts. 3. The presence of coagula. The wound may not have involved any vessel, and there may be no appearance of bleeding, still the edges will be everted, and the muscles and skin retracted. By an observation of this kind made on the body of a new-born child (Case of *Elphick*, March, 1848), Mr. Prince was enabled to state that the child was living when it was inflicted, an opinion afterwards confirmed by the confession of the mother.

Characters of a wound made after death.—If the wound on a dead body be not made until twelve or fourteen hours have elapsed from the time of death, it cannot be easily mistaken for one produced during life. Either no blood is effused, or it is of a venous character, *i. e.*, it may have proceeded from some divided vein. The blood is commonly liquid, and does not coagulate as it falls on surrounding bodies, like that poured out of a wound in the living. The edges are soft, yielding, and destitute of elasticity; they are therefore in close approximation. The cellular and muscular tissues around are either not infiltrated with blood, or only to a very partial extent. There are no coagula within the wound. In experimenting upon amputated limbs, I have found these characters possessed by a wound produced two or three hours after death, although they are best seen when the wound is not made until after the body has lost all its animal heat. In wounds on the dead body, divided arteries have no marks of blood about them, while in the living body the fatal bleeding commonly proceeds from these vessels. Hence in a wound on the living, it will be found that the surrounding vessels are empty. The chief characters of a wound after death are, therefore: 1. Absence of copious bleeding. 2. If there is bleeding it is exclusively venous. 3. The edges of the wound are close, not everted. 4. There is no diffusion of blood in the cellular tissue. 5. There is an absence of coagula. But it may happen that a wound has been inflicted soon after the breath has left the body, and while it was yet warm. The distinction between a wound then made and one made during life, is not so well marked as in wounds inflicted at a later period after death. Observations of this kind on the human subject must of course be purely accidental; and there are many obstacles to the performance of experiments on the recently dead. I, therefore, selected limbs immediately after amputation, and there is no reason to suppose that the results obtained in these cases, would differ widely from those derived from experiments made n the entire body.

Wounds on the dead body.—In the first experiment, an incised wound bout three inches in length, was made in the upper part of the calf of the eg *two minutes* after its separation from the body, by which the thick muscles f the calf and the fascia (membrane) covering the deep-seated layer of the eg, were divided. At the moment that the wound was made, the skin re- acted considerably, causing a protrusion of the adipose substance beneath; he quantity of blood which escaped was small,—the cellular membrane, by s sudden protrusion forwards, seemed mechanically to prevent its exit. he wound was examined after the lapse of twenty-four hours: the edges ere red, bloody, and everted; the skin was not in the least degree swollen, ut merely somewhat flaccid. On separating the edges, a small quantity of uid blood escaped, but no coagula were seen adhering to the muscles. At he bottom of the wound, however, and in close contact with the fascia, was small quantity of coagulated blood; but the coagula were so loose as eadily to break down under the finger. In a second experiment, *ten minutes* fter the separation of the member from the body, an incision of similar ex- nt was made on the outer side of the leg, penetrating through the peronei to the flexor longus pollicis of the deep-seated layer of muscles. In this se the skin appeared to have already lost its elasticity, for the edges of the ound became but slightly everted, and scarcely any blood escaped from On examining the leg twenty-four hours afterwards, the edges of the in- sion were pale, and perfectly collapsed, presenting none of the characters of wound inflicted during life. Still, at the bottom of the wound and inclosed the divided muscular fibres, there were some coagula of blood; but these ere certainly fewer than in the former experiment. A portion of liquid ood had evidently escaped owing to the leg having been moved. Other ex- riments were performed at a still later period after the removal of the mbs; and it was found that in proportion to the length of time suffered to pse before the production of a wound, so were the appearances less dis- ctly marked, that is to say, the less likely were they to be confounded th similar injuries inflicted upon a *living* body. When the incised wound s not made until *two or three hours* after the removal of the limb, although mall quantity of liquid blood was effused, no coagula were found.

It is necessary to remember that, when an incised wound is the cause of th, the person dies either immediately, in which case there is copious eding from the wounded organ or some large vessel, or he dies after some e, in which case, as the wound continues to bleed during the time that he vives, the longer he lives the more copious will be the effusion of blood. a wound inflicted after death, and while the body is warm, nothing of this d is observed. Unless the weapon injure one of the large veins, the bleed- is always slight, so that the *quantity of blood* lost may assist us in determining whether the wound was made during life or after death. When the body has been moved, and all marks of blood effaced by washing, rules of this kind cannot serve a medical witness:—the time at which the wound was actually inflicted must then be deduced from other circumstances. In the case of *Greenacre*, who was convicted in 1837 of the murder and mutilation of a female, this formed a material part of the medical evidence. The head of the deceased had been severed from the body, and the question was, whether this severance had taken place during life or after death. The prisoner alleged in his defence that it was after death; but the medical evidence went to establish that the head must have been cut off while the woman was living, but probably after she had been rendered insensible by a blow on that part, the marks of which were plainly visible. This medical opinion was founded on two circumstances. The muscles of the neck were retracted, and the head was completely drained of blood, showing that a most copious and abundant flow must have ensued at the time of separation, and therefore indicating that the circulation was probably going on at that time. On cutting off a head after death a small quantity of blood may escape from the jugular veins: but this soon ceases, and the quantity lost is insufficient to affect materially the contents of the cerebral vessels. The chief medical witness, Mr. Girdwood, expressed himself with proper caution, by stating, in answer to a question from the judge, that all the wounds in the neck had been inflicted either during life or very shortly after death, while the body still preserved its warmth. The circumstantial evidence tended to show that the deceased was first stunned, and that her head was cut off while she was in a state of stupor.

In any case in which it is doubtful whether a wound was inflicted on a living or dead body, it will be proper to adopt the same cautious mode of expressing a medical opinion: since it must be remembered there are no decisive characters by which wounds of the kind referred to can be distinguished; and a medical witness is as likely to be wrong as right in selecting either hypothesis. It is a considerable step in evidence, when we are able to assert, that a particular wound, found on a dead body, must have been inflicted either during life or *immediately* after death; for it can scarcely be supposed that in a case calling for criminal investigation, any one but a murderer would think of inflicting upon a body immediately after death a wound which would assuredly have produced fatal effects had the same person received it while living. So soon as such an opinion can be safely expressed by a witness, circumstantial evidence will often make up for that which may be, medically speaking, a matter of uncertainty.

Wounds or injuries unattended with hæmorrhage.—The copious effusion of blood has been set down as a well-marked character of a severe wound received during life; but this observation applies chiefly to cuts and stabs. Lacerated and contused wounds of a severe kind are not always accompanied by much bleeding, even when a large blood-vessel is implicated. It is well known, that a whole member has been torn from the body, and that little blood has been lost; but in such cases coagula or clots of blood are commonly found adhering to the separated parts, a character which indicates that the wound was inflicted either during life or soon after death, while the blood was warm and fluid. When a lacerated or contused wound involves a highly vascular part, although no large blood-vessel may be implicated, it is liable to cause death by loss of blood. In a case tried at the Liverpool Winter Assizes, 1847 (*Reg.* v. *Cawley*), the prisoner was charged with having caused the death of his wife by kicking her in the lower part of the abdomen. Copious bleeding followed, and in spite of medical assistance the woman died very shortly afterwards, evidently from exhaustion produced by the loss of blood. It was stated in evidence that there was no external laceration, but an examination of the body showed that a contused wound (of the genitals) had been produced *internally*, and had given rise to fatal bleeding. There is nothing at all remarkable in such a result, considering the great vascularity, *i. e.* the abundance of small blood-vessels, in these parts of a female.

Ecchymosis from violence.—Contusions and contused wounds are commonly accompanied by a discolouration of the surrounding skin, to which the term ecchymosis (ἐκχύω, to pour out) is applied. The subject of ecchymosis is of considerable importance in legal medicine, since it has often given rise to medical difficulties and complicated questions. It consists essentially in the extravasation or effusion of blood generally from small ruptured vessels, into the surrounding cellular membrane beneath the skin. An ecchymosis is commonly superficial, affecting only the layers of the skin, and showing itself externally, either immediately or in the course of a short time, in the form of a deep blue or livid red patch. According to Dr. Chowne, the former colour is met with in the ecchymosis slowly produced; while that which is the immediate result of violence is red or livid red. In some instances the ecchymosis is deep-seated, the blood being poured out among the muscles and beneath the fasciæ or membranes enclosing them: its extent cannot then be so readily determined by the external discolouration, for this is commonly slight, and it may appear only after the lapse of some hours, or even two or three days. Sometimes the ecchymosis shows itself not over the immediate seat of injury or around it, but at some distance from it. Dr. Chowne met with an instance in which a young man received a severe bruise on the inner side of the ankle. In two days, ecchymosis appeared around the outer ankle. When blood has once escaped from the small vessels, it will sooner or later diffuse itself where it meets with the least resistance, and the layers of skin in the part struck, may become so condensed by the blow, that the blood is diffused in the cellular membrane of the adjoining parts. Mr. Syme met with a case in which a compound fracture of the tibia, about one-third down, was produced by the wheel of a carriage passing over the leg of a woman. There was no ecchymosis around the seat of injury, but after some days, the skin of the knee nd lower part of the thigh became discoloured. ('Ed. Med. and Surg. Jour.' Oct. 1836.) Ecchymosis may sometimes proceed from causes irrespective of the direct application of violence to the skin. Strong muscular exertions, the act of vomiting, and many other conditions, may give rise to a rupture of the minute vessels, and to an effusion of blood in parts which have been stretched or compressed. I have known it to have been produced to a great extent around the knee (without any blow), from the stretching of the ligament of he kneepan in an individual who was trying to save himself from suddenly alling forwards with his knee bent under him. Such cases are commonly ecognized by there being no mark of mechanical injury about the part; the kin is smooth and unabraded.

Ecchymosis strictly signifies an effusion or a pouring out of blood; but the ffusion may be so deep-seated as not to present any external discolouration ecchymosis). It is scarcely necessary to observe that the term *effusion* applies internal as well as to external hæmorrhage, and unless this be borne in mind edical testimony may be wholly misunderstood. Dr. Christison states that me years ago, on a trial in the High Court of Justiciary at Edinburgh, the ublic prosecutor attempted to prove that the person assailed had been wounded the *effusion* of blood, which, according to the law of Scotland, is an aggravation of guilt in such cases. When the principal medical witness was examined to the injuries inflicted, he was asked whether any blood had been effused; nd he replied that a good deal must have been effused. But he meant effusion of blood under the skin, constituting the contusion or bruise described, while the Court at first received the answer as implying that there had been a considerable loss of blood from a wound externally. The ambiguity was, however, detected. ('Edinburgh Monthly Journal,' Nov. 1851, p. 454.) This case shows the importance of medical evidence being given in language intelligible to all. At the same time the amount of personal injury inflicted is not at all dependent on the external effusion of blood. The assault may be of a most grievous kind, and yet no blood be effused through a wound in the skin.

Violence inflicted on a living body may not show itself under the form of ecchymosis until *after death.* A case of this kind was communicated to me by Mr. J. Steavenson. A man received from behind several kicks on the lower part of the abdomen, which caused a rupture of the bladder, and death by peritonitis. He died in about thirty-five hours; but there was no ecchymosis in the seat of the blows, *i. e.* in the pubic and lumbar regions, until after death. Dr. Hinze met with a case of suicidal hanging, in which it was observed that ecchymosis appeared in the course of the cord only after death. (See 'HANGING.') It has been remarked by Devergie that ecchymoses are often concealed on the bodies of the drowned, when first removed from water, owing to the sodden state of the skin; they may become apparent only after the body has been exposed for some days, and the water has evaporated.

A medical jurist must guard against the error of supposing that when a blow has been inflicted on a living person, it is necessary that the individual who is maltreated should survive for a long period in order that ecchymosis should be produced. Among numerous instances proving the contrary, the case of the *Duchess of Praslin* (August 1847) may be mentioned. This lady, who was assassinated by her husband, was attacked while asleep in bed. The number of wounds on her person (thirty) showed that there had been a mortal struggle, which, however, could not have lasted more than *half an hour.* Yet, on inspection, there were the marks of numerous ecchymoses, which had resulted from the violent use of a bruising instrument. ('Ann. d'Hyg.' 1847, t. 2, p. 377.)

Changes of colour.—The changes which take place in the colour of an ecchymosed spot are worthy of attention, since they will serve to aid the witness in giving an opinion on the probable time at which a contusion has been inflicted. After a certain period, commonly in eighteen or twenty-four hours, the blue or livid margin of the spot is observed to become lighter; it acquires a violet tint, and before its final disappearance it passes successively through shades of a green, yellow, and lemon colour. During this time, the spot is much increased in extent, but the central portion of the ecchymosis which received the violence is always darker than the circumference. These changes have been referred by Chaussier and others to the gradual dilution of the serous portion of the effused blood by the fluid of the cellular membrane, and its slow and uniform dispersion throughout the cells. The colour is finally entirely removed by the absorption of the blood. The extent and situation of the ecchymosis, the degree of violence by which it has been produced, as well as the age and state of health of the person, are so many circumstances which may influence the progress of these changes. Thus an ecchymosis is longer in disappearing in the old than in the young. Mr. Watson, of Edinburgh, found effused blood in an ecchymosis in an old person, five weeks after the infliction of the injury. Where the cellular membrane is dense, the ecchymosis, *cæteris paribus*, is not so rapidly formed; nor, when formed, do the above changes take place in it so speedily as when the blood is effused into a loose portion of membrane like that surrounding the eye or existing in the scrotum. In some instances an ecchymosis has been observed to disappear without undergoing changes of colour at its margin. On examining an ecchymosed portion of skin which has suffered from a severe contusion, we find that the discolouration affects more or less the whole substance of the true skin, as well as the cellular membrane beneath; it is necessary to remember this in forming an opinion.

Evidence from the Form of an Ecchymosis.—It not unfrequently happens that the ecchymosis produced by a contusion will assume a form indicative of the means by which the violence was offered. In hanging, the impression caused by the cord on the neck is sometimes ecchymosed, and indicates its course with precision;—so also in strangulation, when the fingers have been violently applied to the fore part of the neck, the indentations produced may serve to point out the manner in which life was destroyed. A case is mentioned by Starkie, which shows that the form of an ecchymosis may occasionally furnish presumptive evidence against an accused party. In an attempt at murder, the prosecutor, in his own defence, struck the assailant violently in the face, with the key of the house-door, this being the only weapon he had near at hand. The ecchymosis which followed this contusion corresponded in the impression produced on the face to the wards of the key; and it was chiefly through this very singular and unexpected source of evidence, that the assailant was afterwards identified and brought to trial. ('Law of Evidence,' vol. 1, art. Circ. Ev.)

Contusions on the dead.—For our knowledge of the effects of *contusions* on the recently *dead* body, we are chiefly indebted to Dr. Christison. This gentleman found that blows inflicted not more than *two hours* after death, gave rise to appearances on the skin similar to those which resulted from blows inflicted on a person recently before death. The livid discolouration thus produced generally arose from an effusion of the thinnest possible layer of the fluid part of the blood on the outer surface of the true skin, but sometimes also from an effusion of blood into a perceptible stratum of the true skin itself. He likewise found that dark fluid blood might even be effused into the subcutaneous cellular tissue on the seat of the discolourations, so as to blacken or redden the membranous partitions of the cells containing the fat; but this last effusion was never extensive. From this, then, it follows, that, by trusting to external appearance only, contusions made soon after death may be easily confounded with those which have been produced by violence shortly before death.

If a contusion has been caused some time before death, there will be swelling of the part, and probably also certain changes of colour in the ecchymosed patch, in either of which cases there will be no difficulty in forming an opinion. Although ecchymosis, or an appearance analogous to it, may be produced on a body after death, the changes in colour are then met with only under peculiar circumstances, to be presently mentioned. If the blood found beneath an ecchymosed spot is in a state of coagulum (clotted), this will afford a presumption of its having been effused during life, although, strictly speaking, it only proves that the effusion must have taken place either before death, or very soon after it. The experiments related, in speaking of incised wounds, show that blood effused from a wound ten minutes after death, may be found in a coagulated state. (See page 385.) Again, the circumstance of the blood effused under a contused wound being *liquid*, is not a proof that the effusion took place after death; for sometimes, as in death from a sudden and violent shock to the nervous system, or in cases of rupture of the heart, the effused blood does not coagulate. Blood effused into the spinal canal during life is often fluid, and it is well known that blood may be found coagulated in some parts of the body, while it remains uncoagulated in others. There is reason to believe that the blood coagulates more slowly in the dead body than in a vessel into which it has been drawn during life or after death. The blood may remain fluid in a dead body from four to eight, and, according to Donné, as long as twelve hours after death.

('Cours de Microscopie,' 52.) It rarely begins to coagulate until after the lapse of four hours; but if drawn from a blood-vessel and exposed to air, it would coagulate in a few minutes after its removal.

In general, contusions which have been produced during life, and in which the effused blood remains liquid, may be recognized by the *extent* of the effusion. If, under the ecchymosed parts, we find a large quantity of liquid blood, and the seat of injury is so situated that the blood could not have become infiltrated into it, and at the same time there is no ruptured vein from which it might have flowed, we may confidently pronounce that the effusion must have preceded death. In a dead body, a contusion would cause but little extravasation, unless a vein of large size had been torn through. The sign which is most satisfactory as a criterion, in the opinion of Dr. Christison, is, however, the following:—In a contusion inflicted during life, the ecchymosed portion of cutis (true skin) is generally dark and much discoloured by the infiltration of blood throughout its whole thickness; the skin at the same time is increased in firmness and tenacity. This is not, however, a uniform consequence of a contusion during life; for a blow may cause effusion of blood beneath the skin without affecting the cutis in the manner stated. The state of the skin here described, cannot, however, be produced by a contusion on a dead body; although it is still an open question, whether it might not be produced if the contusion were inflicted a few minutes after death. As it is, the value of this sign is somewhat circumscribed,—it is not always produced on the living,—it might be possibly produced on the recently dead; so that when it does not exist, we must look for other differential marks, and when it does exist, we ought to satisfy ourselves that the contusion was not inflicted recently after death.

The period at which such injuries cease to resemble each other, has not been fixed with any degree of precision; but, as in the case of incised wounds, it would seem that there is little danger of confounding them, when a contusion has not been inflicted on a *dead* body until after the disappearance of animal heat and the commencement of cadaveric rigidity. Dr. Christison found that sometimes the appearance of contusions could hardly be produced on a dead body two hours after death; on other occasions they might be slightly caused after three hours and a quarter, but this period is near the extreme limit. Whenever the warmth of the body and the laxity of the muscles are not considerable at the time the blow is inflicted, the appearance of contusions during life cannot be distinctly produced. It is, therefore, only on the trunk that even in the most favourable state of the body,—namely, when warmth is retained and the blood remains altogether liquid,—that a mark resembling a contusion on the living body can be produced so late as *two hours* after death. ('Ed. Med. and Surg. Jour.' No. 99, p. 247, *et seq.*) Notwithstanding these satisfactory results, it will be seen, that from the moment of death until after a lapse of two hours, contusions may be followed by appearances on the dead almost identical with those observed on the living. The *earliest period* after death in which an experiment was tried on the human body was *one hour and three quarters*: in this case the similarity was so strong, that we may infer, if the experiments had been performed within half an hour, or even an hour after dissolution, it would have been difficult to say whether the blow producing the discolouration, had been inflicted on a living or dead body. Dr. Christison's experiments lead to the conclusion that *severe* blows inflicted on a recently dead body, produce no greater degree of ecchymosis or cutaneous discolouration than *slight* blows inflicted on the living. Assuming that the great extent of an ecchymosis would in all cases serve to show that the violence in producing it had been inflicted during life, it must be remembered that the importance of these facts, in relation to medical evidence, is not affected by the extent of the discolouration. It may be just as necessary to have a positive opinion on the origin of a *slight*, as on the origin of an *extensive* bruise. Trivial ecchymoses, as in cases of strangulation, if they can be certainly pronounced vital, may make all the difference between the acquittal and conviction of a person charged with murder. Again, slight ecchymosis on the bodies of the drowned may excite a suspicion of strangulation and subsequent immersion of the body in water. So in reference to child-murder. An infant may be destroyed by violence, and only a few slight marks of ecchymosis found upon its body. Irrespective of the *extent* of an ecchymosis, the great point for a medical witness to consider is, whether it occurred during life or after death. Cases in which a mistake might easily have arisen, will be related in speaking of marks of violence on the drowned.

The practical inference, then, is, that these discolourations of the skin caused after death, are liable to be mistaken for marks of violence on the living body. An instance has been communicated to me, on respectable authority, in which, for the sake of experiment, blows with a stick were inflicted on the recently dead body of a female, while still warm. The body was afterwards accidentally seen by non-professional persons, who were not aware of the performance of these experiments; and so strong was the impression from the appearances, that the deceased had been maltreated during life, that a judicial inquiry was actually instituted, when the circumstances were satisfactorily explained. The fact, therefore, that severe blows after death resemble slight blows during life, is, in a practical view, unimportant. It does not aid our diagnosis, nor prevent serious mistakes from occurring.

Ecchymosis from natural causes in the living.—There are certain conditions of the living body in which ecchymosed marks are found on the skin: a witness must be careful not to confound these marks with ecchymosis arising from violence. First with regard to the living body,—in aged persons, it is not unusual to find the legs and feet covered with livid patches, sometimes of considerable uniformity of colour, and at others much mottled. These discolourations, which, after death, might be mistaken for ecchymosis from violence, arise from the languor of the capillary circulation in such persons: the blood with difficulty finds its way through the venous capillaries, and the marks are commonly observed on the lower parts of the body, because they are far removed from the centre of circulation, and the blood has to rise contrary to gravitation. This is the condition which has been denominated by Andral, asthenic hyperæmia. (Andral, 'Anat. Pathol.' t. 1, p. 40.) Similar discolourations are sometimes met with on the bodies of those who have died from scurvy, typhus, and other adynamic diseases. In persons severely affected with scurvy, it is well known that the slightest pressure on any part of the skin will suffice to produce a spot resembling the ecchymosis of violence, and arising like it from a rupture of minute cutaneous vessels; but the effusion of blood, which causes the discolouration, is commonly confined to the superficial layers of the true skin. These patches, under certain states of the system, occur spontaneously, and often cover the body to a great extent: when small, they take the name of *petechiæ*, but when extensive, in which case they bear some resemblance to the ecchymosis of violence, they constitute the pathognomonic character of the disease termed *purpura*. To all these effusions of blood in the living body, the term *Sugillation* (from *sugillatio*, a black mark) has been applied. Some medical jurists have attempted to draw a distinction between ecchymosis and sugillation: thus it is said, ecchymosis proceeds from external, sugillation from internal, causes; ecchymosis is confined to the marks which occur in the living body, sugillation to those which occur in the dead:—in ecchymosis the vessels are ruptured, in sugillation there is mere congestion; again, some have considered that ecchymosis and sugillation might take place both in the living and the dead. (Henke, 'Zeitschrift der S. A.' vol. 1, p. 199, and 'Ann. d'Hyg.' 1838, vol. 2, p. 383.) From this statement, it appears impossible to give a consistent definition of the meaning of either of these terms: but it is altogether unnecessary to make the attempt, for the error, after all, consists in the introduction of a superfluity of words to express a simple condition of the body, depending on different causes. Why, according to the view taken by Chaussier, an ecchymosis should not also be called a sugillation, it is difficult to say: for the definitions above given create no real distinction. I would advise a medical jurist to avoid the use of the term sugillation, if by employing it he considers that he is speaking of a condition essentially different from ecchymosis. It may be occasionally necessary to distinguish ecchymoses in the living body arising from infirmity or disease, from those which have their origin from violence. In regard to the spots or patches on the legs of old persons, their great extent, enveloping as they often do the whole circumference of a leg, is sufficient to establish a clear distinction. In distinguishing the spots of *purpura*, a difficulty may sometimes exist, but here also the appearance of the subject, the general diffusion of the spots over the whole of the body, and their simultaneous existence on the mucous membrane of the throat and alimentary canal, cannot fail to point out that they originate from some other cause than violence. In the living, these spots have been observed to undergo the same changes of colour as the true ecchymosis of violence. It has been alleged, on the authority of Zacchias, one of the early writers on medical jurisprudence, that a distinction is obtained in these cases after death by a dissection of the part. According to this authority, in what is termed sugillation, *i.e.*, the ecchymosis of disease, the blood is fluid, while in the ecchymosis of violence it is described as being in a thick and concrete state. In the remarks already made respecting contusions, facts have been mentioned which show that such a distinction is inadmissible; neither the state of the blood nor its situation will alone suffice to determine the question. Although it has been usual to describe the ecchymosis of disease as being due to a superficial extravasation on the true skin, yet certain cases recorded by pathologists prove that in purpura or scurvy, the discolouration may occasionally extend through the whole substance of the skin to the fatty tissue beneath.

Ecchymosis in the dead body. Lividity.—Ecchymosis may present itself in various forms on the skin of a dead body. The first form when it occurs, is almost an immediate consequence of death, but it is not fully developed until the body has cooled. It is commonly called *cadaveric lividity.* It presents itself in diffused patches of great extent, sometimes covering the whole of the fore part of the chest and abdomen, at other times the lateral regions of the back. The upper or lower limbs, either on their internal or external surfaces, or on their whole circumference, are often thus completely ecchymosed. The appearance is wholly unlike the effects of external violence. (See p. 46.) Ecchymosis may be a result of putrefaction from the fluid blood escaping from a vessel. (See p. 48.)

Is Ecchymosis a necessary result of violence?—This medico-legal question has often created great difficulty to medical witnesses. It has been repeatedly asserted in Courts of law, that no severe blow could have been inflicted on the body of a person found dead, in consequence of the absence of ecchymosis or other indication of violence from the part struck; but this assertion is entirely opposed to well-ascertained facts. However true the statement may be that severe contusions are commonly followed by ecchymosis, it is open to numerous exceptions; and unless these are known to a practitioner, his evidence may mislead the Court. The presence of ecchymosis is commonly presumptive evidence of the infliction of violence, but its absence does not negative this presumption.

It was long since remarked by Portal, that the spleen had been found ruptured from blows or falls, without any ecchymosis or abrasion of the skin appearing in the region struck. This has been also observed in respect to ruptures of the stomach, intestines, and urinary bladder, from violence directly applied to the abdomen. Portal supposed that the mechanical impulse was simply transferred through the supple parietes (or skin) of the abdomen to the viscera behind, as in the striking of a bladder filled with water. Whether this be the true explanation or not, it is quite certain that the small vessels of the skin often escape rupture from a sudden blow, so that their contents are not effused. A case is reported by Henke, in which a labouring man died some hours after fighting with another, and on an inspection of the body the peritoneum was found extensively inflamed, owing to an escape of the contents of the small intestines, which had been ruptured to a considerable extent. There was, however, no ecchymosis or mark on the skin externally, and the medical inspectors were inclined to affirm, contrary in this case to direct evidence, that no blow could have been struck; but others of greater experience were appealed to, who at once admitted that the laceration of the intestines might have been caused by a blow, even although there was no appearance of violence externally. Mr. Watson states that a girl, aged nine, received a smart blow upon the abdomen from a stone. She immediately complained of great pain; collapse ensued, and she died in twenty-one hours. On inspection there was no mark of injury externally, but the ileum (small intestines) was found ruptured, its contents extravasated, and the peritoneum extensively inflamed. ('On Homicide,' p. 187.) Dr. Williamson, of Leith, met with a case in which a man received a kick on the abdomen from a horse: he died in thirty hours from peritonitis. The ileum was found to have been torn completely across in its lower third. There was not the slightest trace of ecchymosis externally, a fact which is the more remarkable, since the blow was here struck by a somewhat angular or pointed body—the hoof of a horse. ('Med. Gaz.' May 1840.) In a fatal railway accident which occurred at Leicester in November 1854, there were no marks of external violence on the head, but Mr. Macaulay found a laceration of the left hemisphere of the brain, with effusion of a large quantity of blood which had coagulated.

Many cases might be adduced in support of the statement that ecchymosis is not a necessary or constant result of a severe blow; but those above related sufficiently establish the fact. This medico-legal question frequently arises in cases in which the bladder or liver is ruptured, as, owing to the general absence of marks of violence, it is often alleged in defence that no blow or kick could have been inflicted on this part of the abdomen. The incorrectness of this view will be apparent by a reference to cases of ruptured bladder related in another part of this work. I am indebted to Dr. Easton of Glasgow, for a case of rupture of the liver, under circumstances in which ecchymosis would have been generally expected to take place as a result of violence. In January 1852, a woman, aged seventy-five, was run down by a cab in the streets of Glasgow, and died in less than half an hour. No ecchymosis existed, although four ribs on the right side of the chest at the lower part were broken, and the liver was ruptured in two places longitudinally, and throughout the entire length of its anterior and convex surface. The laceration of this organ had not been caused by the fractured ends of the ribs penetrating downwards, for of these there was no displacement, but the organ seemed to have burst in consequence of the heavy compression to which it had been subjected, which had not, however, been sufficient to occasion any discolouration of the skin externally. The following case was tried before the Justiciary Court of Glasgow, in January 1837. A woman was found dead in her house, and her husband was accused of having murdered her. There was no mark of violence externally; but on opening the abdomen, the liver was found extensively lacerated, and there was no doubt that this was the cause of death. A medical witness asserted, that as there was no appearance of injury externally, the rupture could not have been caused by a fall or a blow. He attributed the absence of marks of ecchymosis to the rupture having been occasioned by the forcible pressure of some heavy rounded smooth body on the abdomen. The prisoner was acquitted on a verdict of not proven. The liver is seldom ruptured except from violence directly applied, and it is observed that the rupture is more commonly caused by a *sudden* than by a slow application of violence. The explanation given by the witness would neither account for the rupture nor for the absence of ecchymosis; for these conditions are more commonly met with under directly opposite circumstances. At the same time, in cases where the facts are imperfectly known, a surgeon must not be too ready to assume, in the absence of ecchymosis or abrasion, that violence has been directly applied and has caused the rupture of an internal organ. The liver may have been ruptured in the above case either by a blow or a fall,—the absence of ecchymosis in the skin of the abdomen is not inconsistent with either view. That murderous violence may be produced by blows on a body without leaving any external marks, is further proved by a case tried in Scotland (*Cuming* for the murder of his wife, Dec. 19, 1853). The woman died from a severe injury to the head, but she chiefly complained of great pain in one of her breasts, and in her chest on that side. From her statement it appeared that the prisoner had used great violence to this part of her body; yet on a careful examination, during life and after death, there were no marks of ecchymosis or contusion. The case of *Slater and Vivian* (Central Crim. Court, Sept. 1860), charged with the manslaughter of a lunatic at Colney Hatch Asylum, presents many points of importance in reference to this medico-legal question. (Winslow's 'Med. Critic, and Psychological Journal,' No. 1, Jan. 7, 1861, p. 91.)

CHAPTER 33.

EVIDENCE OF THE USE OF A WEAPON—CHARACTERS OF WOUNDS CAUSED BY WEAPONS—INCISED, PUNCTURED, LACERATED, AND CONTUSED WOUNDS—STABS AND CUTS—WHAT ARE WEAPONS?—EXAMINATION OF THE DRESS—WOUNDS PRODUCED THROUGH THE DRESS.

Evidence of the use of a weapon.—It is not necessary to prove that a weapon has been used for the production of a wound, for the words of the new statute are:—'Whosoever shall, *by any means whatsoever*, wound or cause any grievous bodily harm to a person,' &c.; yet evidence of the use of a weapon in cases of assault may materially affect the amount of punishment awarded on conviction. When, upon the clearest evidence, it is certain that a weapon has been used, it is not unusual for prisoners to declare that no weapon was employed by them, but that the wound had been occasioned by accidental circumstances. A witness should remember that he is seldom in a position to swear that a particular weapon produced at a trial, must have been used by the prisoner:—he is only justified in saying, that the wound was caused either by it or by one similar to it. Schwörer relates the following case. A man was stabbed by another in the face, and a knife with the blade entire, was brought forward as circumstantial evidence against him,—the surgeon having stated that the wound had been caused by *this* knife. The wounded person recovered; but a year afterwards an abscess formed in his face, and the broken point of the real weapon was discharged from it. The wound could not therefore have been produced by the knife which was brought forward as evidence against the prisoner at the trial. ('Lehre von dem Kindermorde.') Although the criminality of an act is not lessened or impugned by an occurrence of this kind, it is advisable that such mistakes should be avoided by the use of proper caution on the part of a witness. (On this question, see the case of *Renaud*, by Dr. Boys de Loury, 'Ann. d'Hyg.' 1839, t. 11, p. 170. As to what is a weapon, see Henke, 'Zeitschrift der S. A.' 1844, vol. 1, p. 67.)

Characters of wounds produced by weapons.—Let us now suppose that no weapon is discovered, and that the opinion of a witness is to be founded only on an examination of a wound. It is right for him to know that on all criminal trials, considerable importance is attached by the law to the fact of a wound having been caused by the use of a weapon; since this generally implies malice, and in most cases a greater desire to injure the party assailed than the mere employment of manual force. Some wounds, such as cuts and stabs, at once indicate that they must have been produced by weapons.

1. *Incised wounds.*—In incised wounds, the sharpness of the instrument may be inferred from the cleanness and regularity with which the edges are cut: in stabs, also, the form and depth of a wound will often indicate the kind of weapon employed. Stabs sometimes have the characters of incised punctures, one or both extremities of the wound being cleanly cut, according to whether the weapon was single or double-edged. Dupuytren has remarked that such stabs, owing to the elasticity of the skin, are apparently smaller than the weapon—a point to be remembered in instituting a comparison between the size of a wound and the instrument. A lateral motion of the weapon may, however, cause a considerable enlargement of the wound. (See case, 'Ann. d'Hyg.' 1847, t. 1, p. 400.) When a stab has traversed the body, the entrance-aperture is commonly larger than the aperture of exit; and its edges, contrary to what might be supposed, are sometimes everted, owing to the rapid withdrawal of the instrument. That facts of this kind should be available as evidence, it is necessary that the body should be seen soon after the infliction of a wound, and before there has been any interference with it.

Punctured wounds.—It is necessary to notice whether the edges of a punctured wound are lacerated and irregular, or incised; because it may be alleged in defence, that the wound was produced by a fall on some substance capable of causing an injury somewhat resembling it. In a case that occurred to Mr. Watson, a deeply penetrating wound on the genital organs of the deceased, which had evidently caused the woman's death, was ascribed by the prisoners charged with the murder, to her having fallen on some broken glass; but it was proved that the edges of the wound were bounded everywhere by clean incisions, which rendered this defence inconsistent, if not impossible. I have known a similar defence made on two other occasions, where the cases came to trial. In one, a man struck the prosecutor, and knocked him against a window. On examination, there were three deep cuts on the face of the prosecutor, but no weapon had been seen in the hands of the prisoner. He was charged with cutting and stabbing. The surgeon deposed that the wounds appeared to have been inflicted with a knife or razor-blade, and not by broken glass. If the wounds had been made by glass, particles of that substance would probably have been found in them, but there were none. The prisoner was acquitted, the infliction of the wounds by a weapon not being considered to have been sufficiently made out. In another case that occurred in August 1841, the prosecutor was knocked down, and his throat was found severely cut, but there was no direct proof that a weapon had been used. In the defence it was urged that the wound had been produced by a broken pane of glass, but the surgeon described it as a clean cut, five inches in length and one inch in depth, laying bare the carotid artery. He considered that it must have been inflicted by a razor or knife, and that it was a cut made by one stroke of the instrument. In *Reg.* v. *Ankers* (Warwick Lent Assizes, 1845), a clean cut as from a penknife, about two inches long and one deep, was proved to have existed on the person of the prosecutor, who had fallen during a quarrel with the prisoner. Some broken crockery was lying near the spot, and it was alleged in the defence that a fall upon this had caused the wound. This allegation was quite inconsistent with the clean and even appearance of the edges of the wound. The prisoner, in whose possession a penknife had been found, was convicted.

In general, wounds made by *glass or earthenware* are characterized by their great irregularity and the unevenness of their edges. Cases of this kind show that as it is not always possible to know when this sort of defence may be raised, a medical witness should never fail to make a *minute examination* of a wound which is suspected to have been criminally inflicted. A trial for murder took place at the Worcester Summer Assizes, in 1838, in which it appeared in evidence that the deceased had died from a small punctured wound in the thorax. It was five inches and a half deep; it had completely traversed the right ventricle of the heart, and had led to death by loss of blood. The wound was supposed to have been produced by a small skewer, which was found near the spot, but in the defence it was alleged that the deceased had fallen over a tub, and that the wound had been caused by a projecting nail. This allegation, however, was negatived by the surgeon, from the fact of its being a clean *cut* wound. Had it been produced in the manner alleged by the prisoners, this would have been indicated by an irregularity of margin. In the case of *Bryant* (Taunton Lent Assizes, 1849), which involved a charge of maliciously stabbing the prosecutor, the defence was that many flints were lying about in the road, and as the assault took place in the dark, the wound might have been inflicted accidentally during a fall. The medical witness could not say that the wounds had been positively caused by a weapon: they might have been produced by the flints. The prisoner was acquitted, as the statute then required proof that a wound had been inflicted by some instrument. A careful examination made at the time of the injury would most probably have enabled the witness to give a decided opinion, instead of leaving the case open to doubt. A puncture made by a flint during a fall is not likely to resemble a stab with a knife. The wound would present some marks of laceration and great irregularity. As the wound was under the ear, it was by no means probable, from the situation, that it could have been thus caused accidentally.

These medical difficulties are now for the most part removed by the 24th and 25th Victoria, Chapter 100. This must not, however, lead the witness to suppose that a personal injury is not to be carefully examined with a view to the determination of this question. In January 1853, Mr. Hancock was enabled, by the careful examination of a wound, to disprove a charge of maliciously wounding made against innocent persons. A little girl was represented to have received, while sitting over an iron grating, a wound in the pudendum, by some persons pushing a toasting-fork or pointed instrument between the bars of the grating from below. There were no marks of punctures, which would have been found had this statement been true, but a slight laceration of the parts, such as might have been produced by an accidental fall on the edge of the iron grating while the girl was in a sitting position. There were also marks of bruises on the thigh, such as might have occurred from an accident of this kind. The mother of the child had made a false charge for the sake of exciting public compassion and procuring money. A proper medical examination of the injury clearly established that it had resulted from accident. The part of the body in which the injury existed in this case, is not usually exposed to lacerations or punctures from accident; but the child, for a certain purpose, had placed herself voluntarily in this position, and had on her own admission slipped, and thus probably injured herself.

2. *Lacerated and Contused wounds.*—Lacerated wounds do not in general present greater difficulty with regard to their origin than those which are incised or punctured. The means which produced the laceration are commonly well indicated by the appearance of the wound. These injuries are generally the result of accident; they are, however, frequently met with on the bodies of new-born children, in which case they may give rise to a charge of infanticide. If it could be proved that they had arisen from the use of a weapon, this would, of course, go far to a conviction on a charge of murder. *Contused* wounds and severe contusions present much greater difficulty to a medical jurist. It is not often in his power to say whether a contused wound has resulted from the use of a weapon, from *a blow of the fist*, or *a fall*, by reason of the deceased having accidentally fallen against some hard surface. The question is frequently put to medical witnesses, on those trials for manslaughter which arise out of the pugilistic combats of half-drunken men. One of the combatants is generally killed, either by a blow on the head, by a fall, or by both kinds of violence combined. The skull may or may not be fractured; and the person may die of concussion, inflammation of the brain, or from effusion of blood. The general defence is that the deceased struck his head against some hard substance in falling on the ground, and a surgeon is asked whether the particular appearances might not be explained on the supposition of a fall. A medical witness is rarely in a position to swear with certainty, that a contused wound of the head must have been produced by a weapon and *not* by a fall. Some circumstances, however, may occasionally enable him to form an opinion on this point. If there are contused wounds on several parts of the head, with copious effusion of blood beneath the skin, the presumption is that a weapon must have been used. If the marks of violence are on the summit of the head, it is highly probable that they have been caused by a weapon, since this is not commonly a part which can receive injury from a fall. So if sand, gravel, grass or other substances be found in a contused wound, this will render it highly probable that the injury was really caused by a fall.

It matters not, under the new Statute on wounding, whether the wound was produced directly by a weapon employed by an assailant, or indirectly by any act of violence on his part. A man may fracture the skull of another either by striking him with a brick, or by striking him with his fist and thus causing him to fall against a brick. Acquittals formerly took place upon technicalities of this kind ('Law Times,' March 21, 1846, p. 501): but in *Reg.* v. *Dodd* (Shrewsbury Summer Assizes, 1853) Coleridge J. expressed a strong opinion against the distinction thus made. The prisoner, it was alleged, threw a stone at the deceased, who immediately fell on a stone floor. The deceased was able to go about for several days, but he died, a week after he had sustained the violence, from inflammation of the brain, as a result of fracture of the skull. The medical witness ascribed the fracture to a blow from a stone. In the defence it was urged that the fracture might just as well have arisen from a fall on a stone floor. Coleridge J. held, if the prisoner knocked the deceased down, that it would make no difference whether the deceased died from a fall on the stone floor, or from injury produced by the stone which was thrown at him.

In *Reg.* v. *Howes* (Croydon Summer Assizes, 1863), the deceased, the wife of the prisoner, was found dead with severe contusions on the head and face, and a lacerated wound on the temple. She died from extravasation of blood on the brain. The defence was that deceased had fallen against a fender, while intoxicated, and so had caused the wounds; but it was properly stated by the witness, that although a lacerated wound on the side of the head might have been so caused, the other injuries bore the characters of repeated blows. The counsel for the defence wished to make a general amalgamation of all this violence, although the witness had stated that the head, from the temple to the occiput, was one mass of contusions, independently of the bruises met with on the face. Apart from all scientific speculations, no fall upon a fender could possibly account for the *whole* of these injuries, but it was necessary in addition to assume that the woman was continually drunk (of which there was no proof), and that in falling, her head and face alone invariably suffered! In reference to the cause of the violence, the learned judge (Channell B.) remarked—'If there were blows, and by means of blows the prisoner caused the falls, then though the blows might not themselves be the direct cause of death, he would be responsible for the result.' The prisoner was convicted of manslaughter.

A doubt may arise whether a *weapon* has or has not been used in reference to lacerated or contused wounds. Contused wounds on bony surfaces, as on the head, sometimes present the appearance of incised wounds, the skin being evenly separated. When a wound is recent, a careful examination will generally enable a witness to form a correct opinion, but if some time has elapsed before a wound is examined, great caution will be required in forming a judgment. The following case was communicated to me by a pupil who gave evidence at the trial of the prisoner. The prosecutor, it was alleged, had been stabbed on the head with a knife. The prisoner struck the blow, and he certainly had a knife in his hand at the time, but whether the wound was or was not produced by the knife, could not be determined from the evidence of eye-witnesses. In the defence it was urged that the prisoner had inflicted the wound with his knuckles and not with a knife. When the surgeon was called to examine the wound some time after its infliction, there was so much contusion and laceration about its edges, that it was impossible to ascertain, with the necessary legal precision, by what means it had been caused. There was suspicion, but no medical proof, that a weapon had been employed.

A surgeon should be cautious in listening to the statements of others, that a weapon has been used, unless the wound itself bears about it such characters, as to leave the fact indisputable. During a scuffle, the person assaulted may be easily deceived as to the way in which an accused party inflicted a wound upon him; and a bad motive may sometimes exist for imputing to an assailant the use of a weapon during a quarrel. In such cases we should, as medical witnesses, rather trust to the appearance of the wound for proof of the use of a weapon, than to any account given by interested parties. In a case which was tried in 1842 at the *Chelmsford Assizes*, a surgeon swore that a wound on the nose of the prosecutrix had been produced by a knife, and not by a blow with the fist, as it was alleged in the defence. There seems to have been no good medical reason for the opinion that a knife had been used: it appears to have been founded chiefly on the loose statement of the prosecutrix herself. Nevertheless a conviction followed upon this evidence, and a respectable female, charged as accessary, was sentenced to a severe punishment, not for having assaulted the prosecutrix, for it does not appear that she struck a blow, but for aiding another in the supposed act of stabbing. It was alleged that she handed a knife to the assailant, when it was extremely doubtful, medically speaking, whether any knife had been used in the assault. This case appears to me to convey a serious caution in respect to the medico-legal examination of wounds. A medical man is not justified in giving a hasty opinion of a weapon having been employed from mere hearsay;—he may, in this way, lead to the infliction of a very severe and unmerited punishment.

A late learned judge suggested to me that some means of discrimination between the effects of falls and blows affecting the same part of the body, would greatly aid the administration of justice. There is no doubt that it would, but as no two cases coming under this class of injuries are precisely alike either in the part wounded or the amount of force employed, it is scarcely possible to introduce general rules or to make statistics practically available. It is commonly supposed that a mere fall is not sufficient to produce the same degree of injury that may be caused by a blunt weapon, applied suddenly to the head by human force; but a severe fracture may arise from a simple accident of this kind, and present nearly all the characters of homicidal violence. (See case, p. 404.) The difficulties at criminal trials will, I think, be found to proceed, not so much from want of rules to assign the violence to one condition or the other, as from a want of proper observation when the wounds are first examined. If minute attention were given to an examination of these injuries soon after their occurrence, circumstances would be noticed which would help the medical witness to a conclusion. The defence that they might have been produced by a fall, is not set up until a subsequent period, and the surgeon is then obliged to trust to his memory for the main points of distinction. Such improvised opinions usually fail in impressing a jury.

The case of *Mr. Briggs*, who was murderously assaulted in a carriage on the North London Railway in July 1864, furnishes an illustration of the ease with which homicidal and accidental violence may be distinguished, provided attention is directed to this question at the time. There were several wounds on the head of this gentleman which could not have proceeded from one cause. It appeared probable that some had been inflicted on the deceased by a heavy blunt instrument while he was in the carriage, and that he had then been thrown from it while the carriage was in rapid motion, and the fall had produced other bruises. The surgeon, who examined the deceased, found a transverse jagged wound across the left ear, and above this, there was a scalp-tumour as well as two distinct wounds of the scalp with effusion of blood beneath and corresponding fractures in the bones. There had obviously been more than one distinct application of force to produce such injuries. The fractures in the skull in two distinct places indicated the use of a heavy blunt weapon, while the scalp-tumour was probably caused by the head coming in contact with the ground at that point. A large stone with some blood and light grey hair resembling that of deceased was found in the road near the spot where the body was lying.

In this case the assassin had no doubt intended that death should appear to be the result of an act of suicide,—the fall from a train in motion necessarily producing severe injuries, which might reasonably account for death. An assailant may select his opportunity of inflicting violence upon another while riding on horseback, and by causing him to fall from his horse may thus give the appearance of accidental injuries. A proper medical examination, however, could not fail to reveal the real state of facts. In July 1861, the *Baron de Vidil*, a French nobleman of high social position, was charged with attempting to murder his son, Alfred de Vidil, under the following circumstances. He invited his son on false pretences to take a ride on horseback with him,—he led him into a solitary lane near Twickenham,—fell behind and then suddenly struck his son several severe blows on the head with a heavy riding whip having a metal head. The young man, although severely wounded, was able to keep his seat, and soon procured assistance. The Baron stated that his son's horse had shied and had thrown him against a wall. The surgeon who examined the son soon after the occurrence found on the head two contused wounds of a star-shape cutting through the skin to the bone, one at the upper part of the forehead, near where the hair grows, and the other at the back of the head. There were no scratches or other injuries to the face. The medical witness very properly said that these two wounds in different parts of the head, were inconsistent with their production by any fall or by such an accident as that assigned by the accused. They had the appearance of having been caused by separate blows from some heavy blunt instrument, the force being concentrated on each point. This medical view of the cause of the injuries was borne out by the direct evidence of an eye-witness who saw the prisoner strike the blows. It was proved that, by the death of his son, the prisoner would come into the possession of a large sum of money. The Baron was tried at the Central Criminal Court, and although the son refused to be a witness against the father, he was convicted of an assault by the medical and general evidence.

When it is a question which of two weapons produced certain bruised wounds found on the head, the difficulties of medical evidence are increased. In *Reg.* v. *Teague* (Cornwall Summer Assizes, 1851) the prisoner was charged with the murder of his father-in-law. The deceased was found dead with a large wound in the centre of the forehead. According to the medical evidence, it had the appearance externally of being two, but was in reality only one wound, inflicted by more blows than one. The wound was nearly of a circular figure with a band of skin passing vertically across it. The bone had been driven in to some depth. A large hammer was found near with white hair upon it, but no blood. It was alleged for the prosecution, that the contused wound had been produced by this hammer by the act of the accused, and it was stated by the medical witness that one end of the hammer corresponded to the shape and other physical characters of the wound. The defence was, that the injury had been caused either by a fall or by a kick from a horse. It was not at all probable that any fall could have produced such a wound, without greatly disfiguring the face, which presented no marks of injury; and in reference to its production by a kick, the witness compared the horse's shoes and found that the wound bore no resemblance whatever to them. One circumstance appeared to connect the hammer with the wound, namely, the presence of some white hairs upon it; but the evidence failed to fix the crime upon the prisoner, since it only went to prove that he had had the opportunity of committing the crime, but there was no apparent motive for its commission. ('Med. Gazette,' 1851, vol. 48, p. 729.)

In most instances an accurate observation of the form of a contused wound and an early comparison of it with the supposed weapon or the substance said to have produced it, will enable a witness to come to a correct conclusion on the subject. The situation, depth, and shape of the wound, may be such that no accidental fall could reasonably account for its production. In *Reg.* v. *Skelton* (Carlisle Spring Assizes, 1858), the evidence showed that deceased, an old man, had died from violence to the head. He was found insensible and bleeding in the road, not far from the prisoner's house. An angular stone was lying near to his head. There were no bruises on the body, but on the left side of the crown of the head, the medical inspectors found a square-shaped hole about the size of a half-crown piece,—the bone being there driven in. Three inches below this, above the tip of the ear, there was another fracture of the skull under a narrow scalp wound about an inch in length. In the prisoner's house was found a hammer, which had a square face, the corners only rounded off; and on comparing this with the indented wound and fracture, it corresponded very nearly in shape and width. The other end, when compared with the smaller wound near the ear, also corresponded. The hammer, as it frequently happens with heavy bruising instruments, had no blood upon it, nor anything to indicate that it had been used for inflicting the injuries. The stone found near the deceased had upon it blood and mud at one corner, and a white human hair adhered to it. It was admitted by the medical witnesses that had the deceased fallen heavily upon this stone, it would have accounted for the lesser wound; and with respect to the indented wound, it was suggested that had he been knocked down by a horse and trampled on, the 'caulker' or square piece of iron at the heel of a horse-shoe, might have produced it. They at the same time properly stated that the other part of the shoe would have left some mark, of which there was no trace. The hat worn by the deceased at the time presented no indentation or mark. It is probable from this description that the injury was produced by a weapon, but the evidence failed to connect the prisoner with the act.

In assaults on women, it is not unusual to find that the complainant herself endeavours to exculpate the assailant by ascribing the marks of violence, not to blows, but to some accidental fall. In August 1864, a woman deposed before a magistrate that certain severe injuries which she had sustained had been caused by her falling on a fender. The medical man who examined her, found on the top of the head three distinct wounds which were bleeding. Two appeared as if they had been caused by a blunt instrument: the third on the back part of the head was a clean cut wound. He considered that they had been produced by a chopper, and that none of them had been caused by a fall or a series of falls. The prisoner on this evidence was committed for trial.

3. *Stabs and Cuts.*—It has been remarked, that the law in some cases attaches great importance to the clear proof of the use of a *weapon*; and a medical man has therefore a certain responsibility thrown upon him when, in the absence of a weapon and the denial of its use, he is called upon to say, whether one has or has not been used. In reference to cuts and stabs there can in general be no difficulty, for these injuries carry with them distinct evidence of their mode of production. Formerly stabbing and cutting were treated as distinct from wounding, and very nice legal distinctions were drawn between these terms, which had the effect of procuring acquittals on mere legal technicalities. Under the new consolidated Act, the words 'stab' and 'cut' are properly omitted, and the word 'wound' only has been retained. Medical men would always agree upon a stab or cut being a wound, but they might reasonably differ upon the question whether in a given case a wound was really a stab or cut. It might be punctured, lacerated, or contused, and not fairly come under the professional description either of a cut or a stab. In the meantime, the only party who derived benefit from this grammatical confusion, was the assailant who had inflicted the undefined injury on another. A medical witness has now only to prove that the personal injury falls strictly within the meaning of the term *wound*: he is not called upon to prove the precise variety of wounding to which the injury should be assigned. At the same time, he will always be prepared with a full description of the characters of an injury in case questions on the subject should be put to him.

What are Weapons.—The new statute has also removed those legal doubts which formerly arose in reference to the true signification of the term *weapon.* Thus the teeth, the hands or feet uncovered, were formerly held by the judges *not* to be weapons; and injuries produced by them, however severe, were not treated as wounds within the meaning of the statute. Parties were tried on charges of biting off fingers and noses, and although the medical evidence proved that wounds of a severe kind had been inflicted and that great disfigurement and mischief had been done to individuals, yet the nature of the injury produced was not so much regarded as the actual method by which it was accomplished. The persons charged were acquitted under an indictment for 'wounding,' since wounds in a legal sense could be produced only by weapons, while the teeth, hands, and feet were not weapons in law. From a trial which took place at the Nottingham Assizes in 1832, a strenuous effort was made by counsel to claim for artificial arms and legs the same privilege of exemption that was accorded to natural arms and legs. In the case alluded to, prisoner's counsel argued in defence that a wooden arm with an iron hook at the end of it, with which an assault was committed, had become, by long use, part of the body of the prisoner, and that, like a natural arm, it ought not to be considered a weapon in law! The objection was overruled. Except in so far as the deliberate use of a weapon indicates an intent to inflict a greater amount of personal injury, such questions as these cannot again arise.

Examination of the Dress.—This is sometimes a most important part of the duty of a medical man. In a case of severe wounding, of whatever kind, he should always require to see the dress of the wounded person. It may throw a material light upon the *mode* in which a wound has been produced: it may remove an erroneous suspicion of murder, and may sometimes serve to indicate that a wound has been self-inflicted for the concealment of other crimes, or falsely to impute its infliction to other persons. Marks of blood, dirt, grass, or other substances on the clothing, may also throw a light upon the mode of infliction. So again the use of a weapon, in reference to cuts and stabs, may be inferred from the dress presenting corresponding cuts or perforations. Contused wounds by bludgeons may, however, be readily produced through the dress, without tearing or injuring it. Considerable laceration of the skin and muscles, and even severe fractures, may be caused without necessarily penetrating the dress, supposing it to be at all of an elastic or yielding nature. In self-inflicted or imputed wounds, if of the nature of cuts or stabs, there is often a want of correspondence between the perforations of the dress and the wounds on the person: this is one of the characters by which the correctness of a statement may be tested. (See 'IMPUTED WOUNDS.') A severe wound may be indirectly produced by a bruising weapon, and medical witnesses have been often questioned on this point. Thus, the prosecutor may at the time have worn about his person some article of dress which received the blow, and this may have caused the wound. On a trial for maliciously wounding, which took place at the Reading Spring Assizes in 1837, it appeared in evidence that the prisoner, while poaching, assaulted a gamekeeper by inflicting on his head severe blows with a gun. At the time of the assault, the prosecutor wore a strong felt hat, which, it was contended in defence, had caused the wounds that formed the subject of the charge. The medical witness admitted that the wounds might have been produced either by the gun, or by the hat through a blow from the gun. The prisoner was convicted; this was held to be a wounding, although the gun did not touch the skin. In another case, a blow was struck with a bludgeon at the head of the prosecutor, who wore spectacles. Wounds were produced, which, it was argued in the defence, had resulted from the glass of the spectacles and not from a bludgeon. The prisoner was acquitted.

Every case of this kind must be determined by the circumstances which accompany it. One fact appears to me to be well established from the foregoing cases,—namely, that a medical practitioner should always make a minute and careful examination of wounds which are likely to become the subject of criminal charges, as well as of the dress or clothing worn by the wounded person at the time of the assault. In performing his duties as a surgeon, he is bound, so far as he consistently can, to notice as a medical jurist the characters of all personal injuries, so as to be able to give an opinion on the mode in which they were inflicted. (See case, p. 422.)

When the question is simply, whether the contused wounds resulted from accident or homicide, a careful examination of the dress may tend to remove any medical or legal doubts. A case was tried at the Warwick Spring Assizes in 1808, which not only in this, but in some other points of view, is of great medico-legal importance. In this instance, a man was found dead in a stable, not far from a vicious mare, and the traces of this animal were upon his arms and shoulders when the body was found. The brother of the deceased was tried on the charge of having killed him with a spade, which was found lying in the stable. This spade was stained with blood, but the evidence from this fact was wholly set aside by the circumstance that the spade had been subsequently used in cleaning out the stable. In the defence, it was alleged that the deceased had been kicked by the mare while attempting to put on the traces, and had thus been accidentally killed. According to the medical evidence, there were two straight *incised* (?) wounds, apparently caused by a blunt instrument, on the left side of the head, one about five, and the other about two inches long. On the right side of the head there were three irregular wounds of a mixed lacerated and incised character, two of them about four inches in length. There was also a wound on the back part of the head, about two inches and a half long. There was no swelling round any of the wounds, the skin adhering firmly to the bone. The right side of the skull was generally fractured,—the fracture extending along the back of the head to the left side,—a small portion of the temporal bone having come away. The deceased was found with his hat on, which was bruised in the part corresponding to the seat of injury, but not cut; and there were no wounds on any other part of his body. Two medical witnesses expressed a strong opinion that the injuries could not have been produced by kicks from a horse, grounding that opinion principally on the distinctness of the wounds—the absence of marks of contusion,—the firm adhesion of the skin,—and the straight lateral direction and similarity of the wounds. They also thought that they could not have been inflicted without cutting the hat, if this had been on the deceased's head at the time: and if the hat had been off, that he could not have had the power to put it on after receiving the wounds. The case was not made out against the prisoner, and he was acquitted. (Wills' 'Circ. Evidence,' 302.) Taking the medical facts as they are here reported, there seems to have been no good medical reason for assuming that the wounds on the head were homicidally inflicted. The fact that they had a somewhat incised character, is not a positive proof that the spade was used in producing them, since an instance has occurred where the skin of the scalp presented a similarly incised appearance from the kick of a horse; and I believe it is not an unusual consequence of a severe and sudden blow on those parts of the body where the elastic skin is stretched over round surfaces of bone. In this case, however, another question arose, namely, whether wounds of this description could be inflicted on the head without necessarily cutting through the hat. Admitting it to be improbable that the deceased could have placed the hat on his head after being thus wounded, we must infer that it was on his head at the time, and admitting that the injury was produced by the bruising violence of a horse's hoof, it is easy to understand that the scalp might be wounded and the skin broken without causing more than an indentation in the hat. Had the spade been used, it is less probable that the hat would have escaped the effects of violence. Hence the witnesses who assumed that the deceased had been killed by the spade, were obliged to suppose that the hat must have been off and put on afterwards, therefore that there must have been murderous interference. This, however, would not explain the fact that the hat was indented over the situation of the principal injury. On the whole, this seems to have been really a case of accidental violence, this theory being strongly supported by the condition in which the hat was found on the head of deceased.

It is of some importance as a medico-legal fact, that the skin may be readily wounded through the dress, without the latter being necessarily cut or torn. Mr. Baron Wood, who tried the above case, stated at the time that he remembered a trial at the Old Bailey, where it had been proved that a cut and a fracture had been received without having cut the hat of the wounded person, and evidence was then adduced of the infliction of a similar wound without cutting the hat.

I am indebted to Mr. Codd, coroner for Essex, for an instructive case which occurred in August 1853, showing the importance of comparing the article of dress with the injuries which may have proved fatal. A woman, æt. 60, was found dead in her bed. She had vomited slightly, and there was a small quantity of blood on the floor which had flowed from her nose. She had been seen in her usual health on the previous night. On inspection, there were found two indentations about the middle of the right parietal bone, and there was a large clot of blood in this situation beneath the skin. On removing this clot, the bone was found fractured to the extent of four inches. Nearly three ounces of dark clotted blood were found on the outer membrane of the brain (dura mater), between it and the skull. All the other viscera were healthy. This was the only injury, and quite sufficient to account for death; but a question arose respecting the mode in which this fracture was caused. It was in evidence that on the evening before her death, deceased had been suddenly knocked down, while she was walking in a public road, by a man accidentally running against her. One witness stated that she fell heavily on the back of her head, on which at the time she wore a bonnet. She appeared stunned—was raised up by the men,—some brandy was given to her, and she recovered sufficiently to walk home and eat her supper as usual, after which no one saw her until she was found dead in bed on the following morning. Some suspicion arose that the violence done to the head was too great to be accounted for by a mere fall, and it was a question whether, with such an amount of injury, the deceased could have walked to her home, at the distance of a mile and a half, and have eaten her supper before going to bed. At first it was thought that this was a case of murder, and a man who lodged in the house with deceased was suspected. His room was searched, and a hammer with two claws was found. On comparing these claws with the two indentations and fracture, the medical witness thought that this weapon would at once account for their production. Deceased and this man had been in the habit of quarrelling, and they were the only persons in the house on this occasion. The lodger said that he let the woman in about nine o'clock (the fall in the road occurred about 7.30); her appearance presented nothing unusual, and he saw no more of her until called at seven the next morning, when she was found dead and cold. It was only at the adjourned inquest that the bonnet worn by the deceased at the time of the fall was called for by the coroner. Two indentations were then found upon the back part of it, corresponding to those on the skull of deceased. The indentations on the bonnet contained dust and dirt, thereby confirming the statements of the witnesses, and rendering it probable that the fall in the road had caused the fatal injury to the head.

The examination of the dress, in this case, cleared up what might have been otherwise doubtful. It is probable that the large internal effusion of blood which caused death did not take place until deceased had reached home, and perhaps as a result of the exertion made. She must have died very soon after she went to bed, as her body was found cold at 7 o'clock the next morning. In addition to the caution which this case conveys respecting medical opinions on the origin of wounds, it shows that persons may walk and die at a great distance from the spot where a serious injury to the head has been sustained.

The examination of the clothing in the *Waterloo Bridge* tragedy (page 89) threw a light upon the question of murder. The overcoat presented, in the collar behind and towards the left side, a cut or stab as from a double-edged knife. The undercoat as well as the waistcoat presented the mark of a similar stab corresponding in size, form, and direction to the cut in the collar of the overcoat. The shirt beneath was much stained with blood. The stab took a direction from above downwards, and must have penetrated into the chest. Its situation and direction precluded the idea of its having been self-inflicted. As there was no blood on the overcoat where cut, the weapon had not before been used for inflicting a wound, and the deceased had obviously been stabbed from behind with all his clothes upon him. The theory that this was not a murder would involve the assumption that the overcoat, undercoat, and waistcoat had been placed upon some lay-figure for the purpose of imitating a fatal stab behind, and that the undershirt had been covered with blood to add to the appearance. No reasonable motive could be assigned for such a proceeding.

CHAPTER 34.

WOUNDS INDICATIVE OF HOMICIDE, SUICIDE, OR ACCIDENT—EVIDENCE FROM THE SITUATION OF A WOUND—SUICIDAL WOUNDS IN UNUSUAL SITUATIONS—EVIDENCE FROM NATURE AND EXTENT—SHAPE—EVIDENCE FROM THE DIRECTION OF A WOUND—SUICIDAL AND ACCIDENTAL WOUNDS—WOUNDS INFLICTED BY THE RIGHT OR LEFT HAND—ACCIDENTAL AND HOMICIDAL STABS—EVIDENCE FROM THE PRESENCE OF SEVERAL WOUNDS—THE USE OF SEVERAL WEAPONS—TWO OR MORE MORTAL WOUNDS—WOUNDS PRODUCED SIMULTANEOUSLY OR AT DIFFERENT TIMES.

Wounds indicative of Homicide, Suicide, or Accident.—Supposing that the wound which is found on a dead body is proved to have been caused before death, it may be necessary to inquire whether it was the result of *suicide*, *homicide*, or *accident*. It might at first sight be considered that the determination of a question of this nature was wholly out of the province of a medical jurist. In some instances it may be so, and the settlement of it is then properly left to the legal authorities; but, in a large number of cases, it is so closely dependent for its elucidation on medical facts and opinions, that juries could never arrive at a satisfactory decision without medical evidence. Let us suppose, then, that a medical jurist is consulted in a doubtful case,—What are the points to which he should direct his attention? They are, with regard to the wound, 1, its *situation*, 2, its *nature* and *extent*, and, 3, its *direction*.

1. *Evidence from the Situation of a Wound.*—It is a general principle in which most medical jurists agree, that wounds, inflicted by a suicide, are usually confined to the fore or lateral parts of the body. The throat and chest are commonly selected, when cutting instruments are employed; while

the chest, especially in the region of the heart, the mouth, the orbit and the temples, are the spots generally chosen for the perpetration of suicide by fire-arms. But it is obvious, that any of these parts may be also selected by a murderer, with the especial design of simulating a suicidal attempt; therefore the mere situation of a wound does not suffice to establish the fact of suicide. Dr. Smith considers, in reference to pistol wounds, that if the weapon has been introduced into the deceased's mouth and there discharged, we may take it for granted that 'it has not been done by another' ('For. Med.,' p. 302); but this inference has been rather too hastily drawn, because it is quite within the range of probability, that a cool and calculating assassin may purposely resort to this method of destroying a person in order to conceal the crime. In suicidal wounds from fire-arms, a discolouration by powder of the fingers of the hand which discharged the weapon is sometimes observed; this has also been looked upon as a source of evidence of suicide under doubtful circumstances, but a similar objection, although not with equal force, might be made to its admission. Some have regarded it as fully established in legal medicine, that when wounds exist at the back part of the body, it is a positive proof that they have not been self-inflicted. This situation is certainly unusual in cases of suicide; but, as Orfila observes, it is not the situation, so much as the direction of a wound, which here furnishes evidence against the presumption of suicide. A wound, traversing the body from behind to before in a direct line, is not likely to have resulted from a suicidal attempt: at least, it must be obvious that it would require more preparation and contrivance on the part of a self-murderer, so to arrange matters, that such a wound should be produced, than we can believe him to possess at the moment of attempting his life. Besides, his object is to destroy himself as quickly and as surely as circumstances will permit; he is, therefore, not likely to adopt complicated and uncertain means for carrying this design into execution. Nevertheless, we must not always expect to find suicidal wounds in what an anatomist would pronounce to be, the most appropriate situation to produce instant destruction. A want of knowledge or a want of resolution on the part of a suicide, or the accidental slipping of the hand, will often cause a wound in a part where we might least expect to find it.

Wounds which result from accident or suicide are generally in *exposed* parts of the body. An incised wound in a concealed or not easily accessible part is presumptive of murder: because this kind of injury could have resulted only from a deliberate use of the weapon. Suicidal wounds are, however, sometimes found in the most unusual situations. In December 1842, a surgeon destroyed himself by cutting through the brachial artery and the principal veins of his left arm with a penknife: and in another instance which occurred in 1839, a young man committed suicide by dividing the arteries of the forearm on both sides. It is very rare that we find suicidal stabs in the abdomen or throat, but an instance occurred a few years since, in which a woman destroyed herself by a stab in the lower part of the abdomen, and several similar cases are recorded by medico-legal writers. In an attempt at suicide, which fell under my own observation, a stab was inflicted by a carving knife on the fore part of the neck traversing the parts from the windpipe to the spinal column. In regard to situation, it has been remarked, that there is no wound which a suicide is capable of inflicting upon himself, which may not be produced by a murderer; but there are many wounds inflicted by a murderer, which, from their situation and other circumstances, a suicide would be incapable of producing on his own person. We cannot always obtain certainty in a question of this kind,—the facts will often allow us to speak only with different degrees of probability. A remarkable instance of the singular situation selected for suicidal wounds is reported in the 'Med. Gaz.,' vol. 45, p. 439.

The situation of a wound sometimes serves to show whether it is of an *accidental* nature or not,—a point often insisted on in the defence. Accidental wounds generally exist on those parts of the body which are exposed. Some wounds, however, forbid the supposition of accident even when exposed; as deeply incised wounds of the throat, and gunshot wounds of the mouth and temples. For the report of a case in which an accidental wound on the head, by an axe, closely simulated a homicidal wound, see Casper's 'Wochenschrift,' May 24, 1845.

2. *Evidence from the Nature and Extent of a wound.*—Generally speaking, the wound met with on the body of a suicide, when fire-arms have not been used, is either incised or punctured, *i. e.* a cut or a stab. Contused wounds are rarely seen in cases of suicide, because in producing them there is not that certainty of speedily destroying life to which a self-murderer commonly looks. There are, of course, exceptions to this remark; as where, for instance, a man precipitates himself from a considerable height, and is wounded by the fall. Circumstantial evidence will, however, rarely fail to clear up a case of this description. Greater difficulty may exist when life is destroyed by a contused wound, voluntarily inflicted. A case is related by a medico-legal writer in which a man first attempted to destroy himself by running with his head against a wall; and not having succeeded in his attempt, he struck himself repeatedly on the forehead with a cleaver. By this he produced such violent injury to the brain, that death soon followed. The man was seen to commit the crime by several witnesses: had not this been the case, the nature of the wound was such as to excite suspicion that it had been inflicted by another, and that the man had been murdered.

A close attention to the *shape* of wounds made by cutting instruments will sometimes lead to the development of cases rendered doubtful from the circumstances under which the dead body of a wounded person is found. A few years since, the body of a farmer was found lying on a high road, in one of the midland counties. The throat was severely cut, and he had evidently died from the bleeding which had taken place. A bloody knife was discovered at some distance from the body, and this, together with the circumstance of the pockets of the deceased having been rifled, led to a suspicion of murder. The suspicion was confirmed when the wound in the throat was examined by a surgeon. It was cut, not, as is usual in suicides, by carrying the cutting instrument from before backwards, but as the throats of sheep are cut, when slaughtered by a butcher. The knife had been passed in deeply under and below the ear, and been brought out by a semicircular sweep in front, all the great vessels of the neck, with the gullet and windpipe, having been divided from behind forwards. The nature of this wound rendered it at once improbable that it could have been self-inflicted, and it further served to detect the murderer, who was soon afterwards discovered. The prisoner, who was proved to have been a butcher, was subsequently tried and executed for the crime.

When persons labouring under insanity commit suicide, they often inflict upon themselves wounds of an extraordinary kind,—such as would, at first view, lead to a suspicion that they had been produced by the hand of a murderer: and, therefore, the rules which are here laid down to distinguish homicidal from suicidal wounds, must be guardedly applied to the cases of those persons who are known to have been insane. In 1850, a case occurred at Guy's Hospital, in which a person in a fit of delirium tore away the whole of the abdominal muscles from the lower and fore part of the abdomen. Had the body of this person been found dead with such an unusual and serious personal injury, it is not improbable that it would have been pronounced homicidal and not suicidal. A gentleman was found lying in a state of insensibility in the kitchen of his house, with a cleaver by his side. On examining the head, upwards of thirty wounds were found over the back part of the skull. The wounds, many of which were superficial, had a horizontal direction from behind forwards. One, however, had removed a portion of the skull from the middle of the lambdoidal suture, so that the brain had escaped. This person died four days afterwards, but recovered so far as to admit that he had produced the wounds on himself, of which, from other circumstances, there could have been no doubt. He was a lunatic. This was a most unusual way of committing suicide. Had the deceased been found dead on a public highway, thus wounded, the probability is, that a strong suspicion of murder would have arisen. A case of this kind should be borne in mind when we are called upon to speak to the possibility of certain wounds found on a dead body, having been self-inflicted. ('Med. Gazette,' vol. 24, p. 276.) Dr. Ryan met with a case in which a man contrived to cut his throat exactly between the os hyoides and the larynx, having previously made two distinct cuts on the thyroid cartilage. The wound was of an extensive kind, reaching backwards through the pharynx to the cervical vertebræ, one of which had been touched by the razor. The carotids and jugulars had escaped, but some of the larger branches were divided. He survived about seven hours. ('Med. Times,' Jan. 17, 1852, p. 73; also 'Lancet,' June 1, 1844. For another case of extensive wounds in the throat by a lunatic, see 'Med. Times and Gazette,' August 27, 1853, p. 219.)

Wounds of the throat when inflicted by suicides, are frequently at the upper part, involving the os hyoides and the thyroid or cricoid cartilages; the large vessels often escape, but the larynx is opened. The wound does not always cause death by hæmorrhage. A woman, æt. 68, after attending a prayer-meeting, attempted suicide by inflicting a wound on her throat. It was between four and five inches long and extended nearly from ear to ear. It laid open the larynx between the hyoid and thyroid bones, and had taken off a portion of epiglottis. There was no arterial hæmorrhage, only a few veins having been divided. The patient did well at first, but inflammation of the lungs set in, and this carried her off on the sixth day. This was a secondary cause of death. ('Ed. Monthly Journal,' Feb. 1863, p. 759.)

The *extent* of a wound, by which we are to understand the number and importance of the parts injured, must in these cases be always taken into consideration. It has been somewhat hastily laid down as a rule, that an extensive wound of the throat, involving all the vessels and soft parts of the neck to the spine, could not be inflicted by a suicide. Although in general, suicidal wounds of this part of the body do not reach far back, or involve the vessels of more than one side, yet we find occasionally that all the soft parts are thus completely divided. These are cases in which, perhaps, with a firm hand, there is a most determined purpose of self-destruction. In a case of suicide, observed by Marc, the weapon had divided all the muscles of the neck, the windpipe, and gullet,—had opened the jugular veins and both carotid arteries,—and had even grazed the anterior ligaments of the spine. A wound so extensive as this, is rarely seen in a case of suicide, but there is no ground for the assertion, that such extensive wounds in the throat are incompatible with self-destruction.

Incised wounds in the throat are generally set down as presumptive of suicide, but murderers sometimes wound this part for the more effectual concealment of crime. Circumstances connected with the form and direction of a wound, may in such cases lead to detection, for, unless the person attacked be asleep or intoxicated, resistance is offered,—evidence of which may be obtained by the presence of great irregularity in the wound, or the marks of other wounds on the hands and person of the deceased. In some instances, however, it is extremely difficult to say whether the wound is homicidal or suicidal,—the medical facts being equally explicable on either hypothesis. (See case by Marc, 'Ann. d'Hyg.,' 1830, t. 2, p. 408; another by Devergie, ib. 414; and a third by M. Ollivier, 'Ann. d'Hyg.,' 1836, t. 1, p. 394.) *Regularity* in a wound of the throat has been considered to be presumptive of suicide. This was the publicly-expressed opinion of Sir Everard Home in the well-known case of *Sellis*. The deceased was found lying on a bed, with his throat extensively cut, and the edges of the incision were regular and even. This condition of the wound, it was inferred, repudiated the idea of homicide, but as a general principle, it appears to me to be a fallacious criterion. A murderer, by surprising his victim from behind,—by having others at hand to assist him, or by directing his attack against one who is asleep or intoxicated, or who from age or infirmity is incapable of offering resistance, may easily produce a regular and clean incision on the throat. This was observed in the case of *Lord William Russell*, who was murdered by Courvoisier in 1840. The wound in the throat possessed all that regularity which has been so improperly regarded as characteristic of suicide. Some have taken a contrary view to that of Sir E. Home; and have contended with more plausibility, that the chief character of a suicidal wound in the throat, is great irregularity from want of steadiness in the hand during the perpetration of suicide. It is by no means unusual in suicides, to find the cut regular at its commencement, and irregular or uneven at its termination, from the loss of blood which attends the first incision; but it is obvious that a homicidal wound might possess these characters. In short, from the foregoing remarks, we are, I think, entitled to say, regularity or irregularity in an incision in the throat furnishes no presumptive evidence either of homicide or suicide.

The nature and extent of a wound or of other injuries on the person will sometimes allow us to distinguish *accident from homicide*. These personal injuries may be such, that they could not possibly have had a suicidal or accidental origin. In a case that occurred at Manchester, in October 1836, it was shown by the medical evidence, that seven ribs were fractured on one side of the chest of the deceased and five on the other. The person charged with murder alleged in defence, that he had merely struck the deceased a slight blow, and that the ribs were broken subsequently by an accidental fall. The medical witness however satisfied the Court that the fall, as described by the prisoner, was inadequate to the production of such extensive violence; and that even had the deceased fallen on *one* side, this would not account for the fracture of the ribs on the *other*. When, therefore, we find in a dead body, severe injuries referred to a fall, we should search the whole of the body carefully for proofs of violence. The insides of the arms or thighs might present marks of injury, which could not possibly be explained on the supposition of an accidental fall. Severe contusions on both sides of the body, or anteriorly and posteriorly, commonly indicate homicidal violence. Some years ago, I assisted in examining the body of a woman who was alleged to have been murdered by her husband. The body presented numerous marks of contusions; one arm was completely ecchymosed from the shoulder to the hand. The person charged with the murder, ascribed these appearances to the fact of his wife having accidentally fallen out of bed; but on examining the bed, it was found to be only a foot from the floor. A fall from this height would not account for the presence of such extensive marks of violence; but irrespective of this, a severe contusion was found on the outer side of the opposite thigh, which, from the appearance, must have been produced about the same time as that on the arm. The existence of this second contusion rendered the defence still less probable; for the woman could not, if she had fallen at all, have fallen on both sides of her body at once; and it was not alleged that she had had more than one fall. In the case of *Reg.* v. *Wallis* (Cent. Crim. Court, 1839), a similar defence was set aside, by the fact that distinct and severe bruises were found on the back of the head and on the temples of the deceased.

3. *Evidence from the Direction of a Wound.*—The direction of a wound has been considered by some to afford presumptive evidence sufficiently strong to guide a medical jurist in this inquiry. It has been remarked that in most suicidal wounds which affect the throat, the direction of the cut is commonly from left to right, either transversely or passing obliquely from above downwards: in suicidal stabs and punctured wounds, the direction is commonly from right to left and from above downwards. In left-handed persons, the direction would, of course, be precisely the reverse. Suicidal wounds are, however, subject to such variation in extent and direction, that it is scarcely possible to generalize with respect to them. Nevertheless, an attention to these points may sometimes be of real assistance to the inquirer, especially when the body has not been moved from its position. It is recommended that the instrument with which the wound has been inflicted should be placed in either hand of the deceased, and the extremity moved towards the wounded part, so that it may be clearly seen whether the direction of the wound could or could not correspond to it in any position. It might happen that neither arm would reach the wounded part, so as to inflict a wound of the particular direction observed: this may be the case in wounds situated on the back. It is obvious that if a murderer makes an incised wound in the front of the throat from behind, the direction will be the same as that commonly observed in cases of suicide. (See on this point the case of *Reg.* v. *Dalmas*, Cent. Crim. Court, May 1844.) Again, if the person attacked is powerless, the wound may be deliberately made, so as to simulate a suicidal act; indeed murderers seldom attack the throat, but with the design of simulating an act of suicide. A homicidal stab may also take the same direction as one which is suicidal, but this would be confined to those cases in which the assailant was placed behind or aside. If in front of the person whom he attacks, the direction would probably be from left to right; but in suicide, when the right hand is commonly used, it is the reverse. Oblique wounds, passing from above downwards, are common to homicide and suicide, but those which take an oblique course from below upwards are generally indicative of homicide, for it is extremely rare, that a person bent on suicide, unless a lunatic, thus uses a weapon. Homicidal incisions, especially in the throat, are often prolonged below and behind the skin forming the angles of a wound, deeply into the soft parts (case, page 407). Those which are suicidal rarely possess this character; they terminate gradually in a sharp angle, and the skin itself is the furthest point wounded,—the weapon is not carried either behind, below, or beneath it. Exceptions to these characters may exist; but in a dark and intricate subject of this nature, we have only these limited rules to guide us. The instrument with which a wound is supposed to have been inflicted, should be adapted to the edges of the incision: its sharpness compared with the cleanness and evenness of the cut, and its length with the depth of the incision or stab. It is no uncommon occurrence for a murderer to substitute some instrument, belonging to the deceased or another person, for that which he has actually employed; and this by its size, shape, bluntness, or other peculiarities, may not account for the appearances presented by the wound.

Suicidal and Accidental wounds.—It is not often that any difficulty is experienced in distinguishing a *suicidal* from an *accidental* wound. When a wound has really been suicidally inflicted, there are generally to be found about it clear indications of design; and the whole of the circumstances are seldom reconcilable with the supposition of accident. But if the position of the deceased with respect to surrounding objects has been disturbed, if the weapon has been removed, and the body transported to a distance, then it will not always be easy to distinguish a wound accidentally received, from one inflicted by a suicide or a murderer. The evidence of those who find the body can alone clear up the case; and the medical witness may be required to state how far this evidence is consistent with the situation, extent, and direction of the wound by which the deceased has fallen. It is unnecessary to dwell further on this subject, since the observations already made will suggest to a practitioner the course which he should pursue. Circumstantial evidence is commonly sufficient to show whether a wound has been accidentally received or not; but as an accidental wound may sometimes resemble one of homicidal or suicidal origin, so it follows that it is not always possible for a medical jurist to decide the question peremptorily from a mere inspection of the wound.

It would not be difficult to produce instances in which murderers, in their defence, have alleged that the wounds observed in the bodies of their victims were of accidental origin, and the allegations have been clearly refuted by medical evidence. A witness must be prepared, therefore, in all cases in which death has taken place in secrecy, and the nature of the wound is such as to render its origin doubtful, to be closely examined by counsel for a prisoner charged with felonious homicide, on the question whether the wound might not have been accidental. The law requires that it should be rendered evident to a jury, before such a charge can be sustained, that the fatal wound could not have had an accidental or suicidal origin.

The death of a person from wounds has hitherto been considered as a subject connected with a criminal charge; but an investigation of the circumstances under which death ensues, is occasionally rendered necessary when the deceased has effected an insurance upon his life. A policy of life-insurance is in some cases rendered void by the act of self-destruction; and therefore a person bent on suicide might, for the sake of his family, take precautions to conceal the manner in which he intended to destroy himself. His body might be found wounded in a way which would render it uncertain whether he had been wounded accidentally, whether he had been murdered, or whether he had fallen by his own hand. In a disputed case it is incumbent on the office to prove the act of suicide (*felo de se*), while the relatives of the deceased would attempt to show the contrary. Such litigation must, of course, call forth a deep and searching investigation into all the circumstances connected with the death of the insured, and the whole case would, in some instances at least, rest almost exclusively on medical evidence. ('Med. Gaz.,' vol. 36, 826.) Numerous cases have of late years occurred in England, which will illustrate the importance of attending to the precise characters of wounds, and the circumstances under which the body of a wounded person is found. The following may serve as illustrations:—

Wounds of the Throat. Cases.—In the year 1837, the late Mr. Dodd, of Chichester, consulted me on the following case:—He was called to examine the body of a woman, who was found dead with her throat cut. The deceased, when seen by him, was lying on her back, and the razor with which the wound was inflicted, was found under the left shoulder. On inquiry, it was ascertained that when first seen, she was lying on her face, and the body had been turned round on the back. Blood had evidently run down the fore part of her person, rendering it probable that she had been wounded while in the erect position. The incision in the throat was deep, and extended obliquely from the right side of the chin, to within about an inch of the left collar-bone.

It had divided the windpipe, the gullet, all the muscles of that side of the fore part of the neck,—the carotid artery, jugular vein, and the muscles on the fore part of the spine, penetrating even into the bodies of the cervical vertebræ. The incision was double,—one superficial, close under the chin, and the other, the deeper one, appeared to be continued from this. The deepest part of the right end of the incision was nearly three inches in a direct line behind the right angle of the wound, so that it extended at that part behind and beneath the sound skin. The cut was four and a half inches long, and two and a half deep. The main question was, whether this could have been a suicidal wound, inflicted by a razor, the only weapon found near the body. Considering its characters, Mr. Dodd inferred that it must have been inflicted by another person, and not by the deceased upon herself. The deceased was right-handed, which would have added to the difficulty of supposing the wound to have been suicidal. The inference drawn was precisely that which the medical circumstances appear to me to justify.

In March 1860, I was consulted in a case which subsequently gave rise to a trial for murder. With every desire to make full allowance for severe and extensive wounds being produced by persons intent on suicide, there must be a reasonable limit to these admissions, or we may arrive at the unsatisfactory conclusion that a man might cut off his own head and afterwards dispose of the weapon at a distance. A young woman was found dead in a farm-house from a wound in her throat. This wound was seven inches long and two inches in depth: it was situated on the left side of the neck, its direction was nearly transverse, but passing slightly upwards from behind forwards. The incision commenced a little in front of the spine on the left side opposite to the second or third spinous process, and terminated about an inch and a half from the centre of the chin,—the fore part of the incision being over the body of the lower jaw and quite superficial, dividing only the skin, cellular tissue, and fat. The important parts involved on the left side were, the external and internal carotids which were cut into but not across; the internal jugular vein, the pneumogastric nerve, and (at the posterior part of the wound) the spinal cord, were *completely severed.* The weapon nearly entered the joint between the second and third cervical vertebræ, about two-thirds of the intervertebral substance between these bones having been divided. A portion of the second vertebra had been cut through, and was left adherent to the lower lip of the wound. The left vertebral artery was also completely divided. The lower lip of the wound was jagged and serrated, and the neck was slightly wounded lower down on the same side, showing that several strokes had been made in this part with the weapon. In the *left* hand of deceased a common dinner knife was found, loosely *held*; it was in a reversed position, with the back instead of the blade towards the throat. The left hand presented three incised wounds over the middle finger, one of considerable depth, and another reaching to the bone over the outer side of the ring finger. The right hand had only one slight wound upon it. The deceased was *right-handed.*

Measured by any scientific rules, such a wound as this was inconsistent with an act of suicide. Assuming that it had commenced behind, the spinal marrow was divided in such a situation that there would be instantaneous destruction of all muscular power, so that the weapon could not be carried forward to the division of the jugular vein and the two principal branches of the carotid artery in front. Assuming that the wound had commenced in front, the division of these large vessels would have rendered it impossible, by reason of the copious loss of blood, to have carried the weapon through the intervertebral substance to the division of the spinal marrow and vertebral artery behind.

There could be no doubt that the wound commenced behind on the left side, and that the weapon was used with great force to cause a division of the bony process of the second vertebra. Its situation, extent, and direction were all inconsistent with suicide. A suicide could have inflicted a wound in this situation and direction only with the right hand, but the weapon was lying loosely in the *left* hand of the deceased. There were deep cuts on the back of the left hand which admitted of explanation only on the supposition that the deceased had raised it to protect her throat. No suicide scores the backs of the hands before inflicting fatal wounds on the throat. A fellow-servant of the deceased, although not at first suspected, was tried at the Carlisle Summer Assizes, 1860 (*Regina* v. *Cass*), and convicted of this act of murder upon his own confession. His clothes were sent to me for examination, and it is worthy of observation that with the exception of a few small spots on the shirt, they were free from any marks of blood. The knife found in the hand of the deceased was bent towards the end as if it had been used against some hard obstacle. It had been wiped; but it still contained in its depressions and irregularities, as well as between the layers of the handles, coagula of blood mixed with rust. One remarkable circumstance brought out by the microscope, appeared to connect the prisoner with this weapon. In a small coagulum found on the knife, dried and fixed to the blade, were some woollen fibres of a peculiar purple brown dye. These corresponded to the fibres of the woollen jacket which the prisoner wore.

Another case possessing some equally remarkable features was referred to me by Sec. Sir George Grey, in Dec. 1862 (*Regina* v. *Edmunds*, Swansea Lent Assizes, 1863). A young woman named *Jane Lewis* was found dead with her throat cut, lying in a pathway not far from the house in which she resided as servant, and a razor taken from the house, was lying near the body. She had left home perfectly well about seven hours previously, to keep an appointment with the man who was charged with the murder. This man was a fellow-servant to whom she was about to be married. There were three distinct and deeply incised wounds in the neck made from left to right—the upper one four inches in length, commencing below the left ear and running parallel to the jawbone; the middle cut about seven inches in length, commencing at the same point and running across the middle of the neck to a spot behind and below the right ear; and the lower cut six inches in length, commencing above the middle of the left collar-bone going in a perpendicular direction, and terminating in the front of the neck by joining the middle incision. The middle cut divided the windpipe, the gullet, and all the great vessels and nerves in front of the neck to the neck-bone. There were two distinct cuts into the spinal column about the third cervical vertebra, one penetrating deeply into the upper edge of the bone, and the other a quarter of an inch below it, commencing on the body of the vertebra and running more deeply to the right side. This divided the transverse process of the vertebra, opened the joint between it and the bone, and severed the vertebral artery. There were deep cuts, which had bled, on the inside and outside of the left hand; and the pad of the middle finger of the right hand had been sliced off, and was found wedged in the joint of the razor. This was half open and lay a yard behind the body. There was no blood upon the handle, while the hands of the deceased were bloody. The deceased's bonnet was found covering a large patch of blood near the razor. A collar which she wore, as well as the strings of her bonnet, had been cut through, and these like the razor were at a distance from the body. It is scarcely necessary to adduce reasons for showing that these wounds could not have been inflicted by deceased upon herself. Apart from all the surrounding circumstances, and looking at the medical description only of the situation, nature, extent, and direction, Mr. Davies, the surgeon, was quite justified in saying that 'it was impossible for any person to inflict such wounds upon himself.' The hacking of the bones of the spinal column in *two distinct places* with such force as to cut off a part of the bone, after both carotid arteries and jugular veins had been cut through, was alone sufficient to justify this opinion. In order to produce these marks, the razor must have been obviously twice used with great force through the same deep incision. There can be no doubt that this was an act of deliberate murder: but there was a failure of proof to trace it to the accused.

Suicides may graze the ligaments in front of the spinal column, but that they should make deep incisions into the bones, cut off hard bony processes, and divide the intervertebral substance and the vertebral arteries, is a proposition contrary to all experience and probability. The case of the *Earl of Essex*, who was found dead in the Tower in July 1683, bore somewhat on this point. The deceased was discovered with his throat cut, and a razor lying near him. This razor was found to be much notched, while the throat was smoothly and evenly cut from one side to the other, and to the vertebral column. Some considered this to have been an act of suicide, others of murder. Those medical witnesses who supported the view of suicide, were asked to explain how it was that such an even wound could have been produced by a notched razor. They attempted to account for this by asserting, that the deceased had probably drawn the razor backwards and forwards across the neck-bone; forgetting that before this could have been done by the deceased, all the great vessels of the neck must have been divided! In *Reg.* v. *Heywood* (Liverpool Winter Assizes, 1855), it was proved that deceased had died from a wound in the throat extending six inches from right to left,—the upper portion of the windpipe was severed as well as the branches of the carotid artery. Her face was concealed by a pillow, the arms were crossed, there was a razor in her right hand, and the back of the razor was towards the body. The hands were clean. A pillow on the other side of the bed was bloody underneath. All these circumstances indicated homicide and homicidal interference after death. The prisoner was convicted. In a former part of this work (pp. 24 and 40) I have referred to the case of *Gardner* (*Reg.* v. *Gardner*, C. C. C., 1862). Among various medico-legal questions to which this case gave rise, was that which we are now considering. Were the wounds in the throat inflicted by deceased on herself or by another person? Without going minutely into details, it may be stated that Mr. Sequeira, the surgeon who was called, found the woman dead,—blood was copiously effused, but only on each side of the neck,—not in front of her person. A large table-knife was loosely placed in her right hand; it was lying in the direction of the length of the body, the back of the blade towards the chest. There was dry blood upon the blade and handle. The fingers on the inside of both hands had been completely cut across, the cuts being quite fresh. The situation and direction of the wounds, which was from right to left, led the medical gentlemen who gave evidence in this case, to state strongly that it was not such a wound as deceased could have inflicted on herself. Assuming it to be in any way possible, the wound must have been produced by the *left* and not by the right hand. The knife was found loosely in the *right* hand of the dead body. This opinion was quite justified by the facts, and thereupon it became a question which of two persons in the house, was guilty of this act of murder. The husband was convicted. (See p. 40.)

It is most important on these occasions, that there should be no disturbance of the body, of the weapon, articles of furniture, or other matters in its immediate vicinity. If the body or the weapon has been carelessly moved or the arrangement of the clothes altered, this may materially affect a medical opinion. There is no case in medical jurisprudence, in which the rule *prius est de crimine quam de reo inquirendum*, is more rigidly enforced than in reference to these wounds of the throat, whether the wounded person survives or dies. Hence much consideration is required before we come to the conclusion that the act was certainly homicidal. It will greatly aid the effect of medical evidence in reference to the situation and direction of wounds in this part of the body, if at the time of inspection a rough diagram of the neck in its fore and back part is made, and lines are so carried as to indicate, by arrows, the direction which the weapon is supposed to have taken. A Court will thus be able to follow more completely the description given by a medical witness, and to appreciate more readily the reasons which he assigns for his opinion.

Wounds inflicted by the right or left hand.—Some remarks have been made in reference to the direction of a cut or a stab varying according to whether the right or the left hand has been used by a suicide. It is necessary for a medical jurist to be aware, that there are many persons who are *ambidextrous*, *i.e.* who have equal facility in the use of the right and the left hand. This may not be generally known to the friends of the deceased: and such persons are often pronounced, even by those who have associated with them, to have been right-handed. A want of attention to this point is said to have been one of the circumstances which led to a suspicion of murder in the case of *Sellis*. (Wills' 'Circ. Evidence,' p. 97.) He was found dead on his bed with his throat cut,—the razor was discovered on the left side of the bed; whereas it was generally supposed and asserted that he was a right-handed man. The truth was, he was ambidextrous,—equally expert in the use of the razor with his left and right hand; and thus the apparently suspicious circumstance of the razor being found on his left side, was at once explained away.

Accidental stabs.—Severe incisions on vital parts do not often happen by accident, but severe punctures and stabs affecting vital organs have frequently an accidental origin. These stabs arise generally from falls, while the person is in the act of running with a pointed instrument in his hand or his pocket. There is one character which, when thus produced, they are commonly observed to possess, namely, that their direction is from below upwards. In this way the truth of a defence may be sometimes tested, as when a prisoner alleges that the deceased threw himself or fell upon the weapon. Homicidal stabs may be likewise directed from below upwards; but this is somewhat rare, and not probable, unless the person is stabbed by an oblique blow, while in the recumbent posture. Rules of this kind may appear to be susceptible of but little practical application; yet cases occasionally present themselves wherein a close attention to situation and direction may materially assist a medical jurist in forming an opinion. In a case of alleged murder, which was tried in 1843 at the Central Criminal Court, a surgeon deposed that he found, on examining the body of the deceased, a stab on the left side of the chest, near the armpit, about six inches in depth. It had wounded the right lung, and had penetrated obliquely into the right auricle of the heart, passing from left to right. He contended, very properly, that, considering the situation and direction of this wound, it was very improbable that the deceased could have inflicted it upon himself. The fact that there may be some instances in which rules of this kind will not be applicable, must not deter us from endeavouring to make a cautious application of them in doubtful cases.

The following cases show how accidental may simulate homicidal stabs. A blacksmith, while forging a piece of rod iron, was irritated at some observations made by a bystander. He made a rush at the offender with the heated iron in his hand, the end being red-hot; he stumbled and fell. In some way the piece of iron became accidentally reversed,—he fell upon the red-hot point, which struck against a portion of the breast-bone, glanced from that, and penetrated the upper part of the left lung. He died in a few days, and the body was examined by order of the coroner. Had only one person been present when this circumstance occurred, a charge of murder might easily have arisen, and the medical and circumstantial evidence might have appeared to favour this view. ('Dublin Med. Press,' January 1845.) How could such an occurrence have taken place by any conceivable accident? The late Mr. B. Cooper relates a case in which a man accidentally inflicted upon himself a stab under very singular circumstances. ('Med. Gaz.,' xxxvi. 264. See also case by Mr. Ollivier, 'Ann. d'Hyg.' 1843, 2, 169.)

The following case is one of some interest in a medico-legal view:—In May 1843, a man was brought to Guy's Hospital with a punctured wound in the back, between his shoulders. It had been inflicted by a stonemason's chisel. The instrument had penetrated to its head, which had prevented it from going further, and had entered the chest, producing a severe wound as it was supposed of the lungs, attended with copious hæmorrhage. It appeared that the man had been drinking and quarrelling with some companions. He had fallen from a blow, but did not complain of being stabbed, and was conveyed home. His wife, on removing his coat, found that his waistcoat and shirt had been penetrated by the chisel, which was still sticking in his back, but the outer coat had not been cut or perforated by it. She withdrew the instrument, when copious bleeding came on, and he was sent to the hospital. The person with whom he had fought was charged with having stabbed him; and it was clear that such a stab must have been either homicidal or accidental. It was elicited from witnesses, however, that no weapon was seen in the hands of the accused,—that the chisel belonged to the wounded man, and that he used it in his trade as a stonemason; there were no marks of blood on the floor where he fell, or on his clothes; that after leaving the public-house where the quarrel took place, he walked with a policeman, who said that the man exhibited no signs of having been wounded, and did not complain of having been struck by any weapon. These facts seemed to show that the stab must have taken place after the quarrel; it was further proved that the wounded man had the chisel in his pocket before the quarrel, and that as the outer coat had not been cut, a homicidal stab could only have been inflicted by the assailant raising this, which was altogether improbable: and then it would remain to be explained how the weapon could have penetrated up to its head.

From the whole of the facts, it was considered that this must have been an accidental stab; although its direction, as such, was remarkable, since, according to the wife's statement, the weapon had not entered the body in a slanting direction, but straightforward, and it required considerable force to remove it. The man recovered, and from the statement which he made, there could be no doubt that it was an accidental stab produced by a fall; but it was certainly extraordinary that it should have been found in such a situation, and taking such a direction. On these investigations, some regard must always be had to the helpless state of intoxication in which a wounde person may be. This may give an anomalous character to accidental stabs o punctures, and render him unconscious of a severe injury. This case furthe illustrates the importance of examining the dress. Had the act been homicidal, the coat would have been found perforated.

At the trial of a *Mrs. Mackinnon* for murder (1823), a careful observatio of the direction of a stab in the chest clearly proved the falsehood of a defence. The deceased had been stabbed with a knife, and on an inspection c the body, it was found that the wound, which was situated over the cartilag of the second left rib, penetrated towards the left, backwards, and very muc downwards, into the lungs. On the part of the prosecution it was allege that the prisoner held a long table-knife daggerwise, drew a blow from he left ear, and struck the deceased in a direction downwards, forwards, and to her right side. The prisoner alleged in defence that she merely held the knife before her, sloping upwards to deter the deceased from attacking her; that he stumbled forward, and fell upon the point of the knife. This statement was in some measure confirmed by some bystanders. As the witnesses on both sides were intoxicated and of disreputable character, the important medical fact to guide the jury was the *direction* of the wound. This was wholly inconsistent with the statement of the prisoner, but perfectly in accordance with the evidence for the prosecution. ('Ed. Monthly Journal,' Nov. 1851, p. 418.)

In *Reg.* v. *Malony* (C. C. C. Sept. 1861), in which a man was convicted of the murder of his wife by stabbing her in the neck, the direction of the wound was not consistent with the testimony of a witness upon whose evidence the case chiefly rested. The medical witness stated that the stab followed the line of the axis of the shoulder, commencing above the collar-bone on the left side, and passed perpendicularly downwards into the chest. It caused almost immediate death. The prisoner stated that his wife had inflicted the wound on herself and had then thrown the knife away; it was found sticking by the blade upright in the floor. There was blood upon the hands of the prisoner and upon his clothes. The medical witness admitted it was possible that the deceased had produced this wound on herself, and in answer to a question by the learned judge (Byles J.), he thought it *probable.* At the trial, a witness came forward and swore that he saw the prisoner stab the woman, but he gave no information to the police, nor said anything about the matter. He was asked what sort of stab it was that he saw the man give to the woman. "The witness made a *forward thrust* with his right arm;" but a wound, such as that described by the surgeon, could have been produced only by a downward thrust, the hand and arm being considerably raised. The medical witness was not further examined on this point, and on this direct testimony the prisoner was convicted of murder. It is a new feature in cases of this kind to have the question of *probability* introduced. When a medical witness has admitted that the wound may have been self-inflicted, he has gone as far as professional knowledge will admit. The question of probability must be solved, if at all, by the other circumstances of the case. In *Reg.* v. *Cogan* (C. C. C. Sept. 1861), also a case in which a man was charged with the murder of his wife by cutting her throat, the wound, according to Mr. Painter, was eight inches long. It commenced at the centre of the back of the neck on the right side, passed downwards and forwards on this side of the neck across the throat to the middle of the left collar-bone. It was a very deep wound; it divided the windpipe, all the principal arteries of the neck, as well as the muscles, and even went into the cervical vertebræ. The deceased probably did not move after receiving it. A bloody razor was found six feet from the body, and there was a pool of blood near this spot, while there were marks on the window-shutter, produced by the spurting of blood from the blood-vessels, in the position in which deceased's body was lying. There were fresh cuts upon the left hand of the deceased, such as would be caused by her grasping some sharp instrument. The medical witness would not say it was impossible, but he thought it highly improbable that deceased could have produced this wound on herself. The prisoner, who had a slight wound in his throat, stated that this had been caused by his wife, who had afterwards destroyed herself. It was proved, however, that no blood had been effused at the spot where he said this wound had been inflicted by her. He was convicted.

Such a wound as that above described could only have been produced, if at all, by the left hand; its situation, direction, and extent, were more consistent with homicide than suicide, and the latter appears to have been clearly negatived by the facts—1. that the deceased had bled in two places, while death must have been almost instantaneous: 2. that the weapon was found at a distance from the body; and 3. that the left hand of deceased was much cut, which could be explained only by the theory that she had endeavoured to protect her throat when attacked. In August 1858, a singular case occurred in London, which was the subject of an inquest, in which a naval officer, *Lieutenant Clavering*, killed a drunken man, without at the time being aware of the fatal result. He and a friend were walking late at night near Acton, when they were attacked by the deceased. In self-defence Lieut. Clavering raised a sword-stick which he carried; the deceased pulled at it, and thus unsheathed it, the lieutenant keeping the sword pointed outwards in self-defence. The deceased fell, but it was not known at the time that he had been stabbed, as he was helplessly intoxicated. At the first place where there was a light on the road, the lieutenant and his friend examined the sword, and they saw no blood upon it. The drunken man was picked up dead, and on examination it was found that he had died from a penetrating wound in the chest, involving the heart. It commenced on the right side of the right nipple, was seven or eight inches long, going straight across the chest to the heart. It must have been given or received when the deceased was standing sideways. The medical witness properly admitted that this direction was quite consistent with accident, and with the mode in which the lieutenant and his friend had stated that the wound, if any, had been inflicted. The only unintelligible part of the case is that the lieutenant holding a sword point outwards, should not have been aware, either by its entrance or withdrawal, that it had penetrated a human body, when the circumstances were such as to render such an accident highly probable. Accidental stabs, when persons are standing upright, are commonly horizontal. Mr. Watson describes the case of a man who, while performing in ‘Rob Roy,’ and when the stage was obscured by smoke,—accidentally ran forward upon the bayonet of one of the soldiers. He received a horizontal stab in the chest, and died in a few seconds. (On ‘Homicide,’ p. 276).

The presence of several wounds.—In suicides, commonly, one wound only is seen, namely, that which has destroyed life, and the presence of several wounds on the body, or the marks of several attempts around the principal wound, have been considered to furnish presumptive evidence of murder. But any inferences of this kind must be cautiously drawn, since not only may a murderer destroy his victim by one wound, but a suicide may inflict many, or leave the marks of several attempts before he succeeds in his purpose. A case is reported in which a gentleman, labouring under mania, attempted to destroy himself. Besides many wounds on the fore-arm, neck, and face, which disfigured him, there were twenty-two in front of his chest. One of these had traversed the heart, producing death after some hours, by causing effusion of blood. (‘Lancet,’ July, 1839.) In wounds of the throat, owing either to ignorance of the situation of vital parts, or to tremulousness of the hand, a suicide often produces one or more incisions of greater or less extent near that which has destroyed life. This is especially the case when the instrument happens to lodge in the first instance on the cartilages of the larynx. The same remark applies to suicidal stabs when the point of a weapon, in being directed against the chest, comes first in contact with the ribs or their cartilages. With respect to the throat, many cases might be cited in which two, three and even six or more incisions have been made in this part by suicides before they have succeeded in destroying themselves. A case occurred to Dr. Handyside (‘Ed. Med. and Surg. Jour.’ Jan. 1838), in which a medical man destroyed himself by inflicting several wounds on his throat. An incision was found on each side of the neck, just below the angle of the jaw, and in the hollow behind it. They were irregular in form, and bore the character of deep stabs. The only important vessel divided was the internal jugular vein on the right side; but, nevertheless, a large quantity of blood was lost, and this was no doubt the cause of death. The case is in many points of view singular, for such wounds, so far as I know, have never before been described in cases of suicide. It would appear that the deceased was ambidextrous, and that the wound on each side of the neck was inflicted by the hand of the opposite side. The following case, which occurred in London in 1839, is somewhat similar: A lady, who had been for several days in a desponding state, was found one morning dead in her bed in a sitting posture. On examination, two very deep and extensive wounds, which had divided the principal blood vessels, were perceived on the right side of the neck. There were two penknives on the bed covered with blood. From the situation and other characters of the wounds, it was inferred that they must have been inflicted with the left hand: although nothing satisfactory could be ascertained on this point. The husband and son slept in the adjoining room. There was no doubt that this was a case of suicide, although it is singular that two deep wounds should have been found thus inflicted by two different weapons on the right side of the neck, in the case of a person who was not known to be left-handed.

The number and nature of the wounds on these occasions generally lead to a strong suspicion of murder. In December 1859, Dr. Lucas, of Crickhowell, consulted me in the following case. A woman, æt. 60, was one morning found dead with severe wounds on the back and front of her neck, apparently made as if in an attempt at decapitation: she was seen alive three quarters of an hour before, and the only person in the house was her husband, an aged feeble man. A large table-knife, newly sharpened, was found near the body. When examined by Dr. Lucas, the following injuries were observed. In front there was an incised wound across the throat, four inches long, from about half an inch on the right side of the median line towards the left ear, dividing the large muscles on the left side of the neck, and the left internal jugular vein, which was gaping. The mark of the cutting instrument was very distinct on the cartilage of the neck, extending rather obliquely down from right to left. On the back of the neck there was a deep gaping wound, extending horizontally from the right ear to the angle of the jaw on the left side, passing down between the third and fourth vertebræ, laying the spinal marrow bare; there was a slight abrasion on the surface of the cord, which might have been accidentally produced during the examination. A second cut was found passing between the second and third vertebræ, also extending to the spinal cord. The skin showed marks of several incisions, the muscles being mangled by repeated cuttings; the edges of the bones were rough, and one slice of bone about the size of a shilling lay almost detached in the wound. The wound in front was separated from the one behind by about half an inch of skin. There were no marks of violence on the hands or on any other part of the body. The evidence at the inquest proved that the son had left the house before the time of her death, and that the deceased had spoken to the neighbours and her husband in a desponding manner a few days before the event. The evidence was generally in favour of the deed being suicidal. It was satisfactorily established that the husband and wife had lived on good terms, and no motive for his perpetrating such an act could be suggested. A verdict of 'wilful murder against some person unknown' was returned. My opinion was subsequently requested on the point whether these wounds were consistent with self-infliction, or whether they necessarily indicated an act of murder. Considering all the medical circumstances, I came to the conclusion that the wounds might have been inflicted by the deceased on herself with her left hand, probably in her attempt to cut off her head. The wounds at the back of the neck were inflicted first, while the principal wound, that which proved fatal by the division of the jugular vein, was inflicted last. The woman had been for some time in a desponding state, and on the evening before the event she had been observed by her husband to pass a knife with her left hand across the back of her neck, as if she was contemplating suicide. There was not the slightest proof of homicide.

The situation and direction of some of the wounds found on a dead body may be medically inconsistent with the theory of a suicidal origin. The following case occurred at New York in September 1839. A woman was found dead, and there were many wounds upon her body. The husband was suspected of having killed his wife, but he asserted that she had destroyed herself. This defence, however, was shown to be inconsistent with the medical facts. Three physicians who examined the body deposed that there were eleven wounds (stabs), eight on and about the left side of the thorax, one of which had penetrated the pericardium, and divided the trunk of the pulmonary artery at its origin; and the others were on the back, near the left scapula. It was considered to be quite impossible that these last-mentioned stabs could have been produced by the deceased, and there was every reason to suppose that the stabs in front and at the back had been inflicted at the same time by an assassin.

The use of several weapons.—In general, suicides, when foiled in a first attempt, continue to use the same weapon; but sometimes, after having made a severe incision in the throat, they will shoot themselves, or adopt some other method of self-destruction. These cases can only appear complicated to those who are unacquainted with the facts relative to self-murder. Neither the presence of several wounds by the same kind of weapon, nor of different wounds by different weapons, can be considered of themselves to furnish any proof of the act having been homicidal. One instance has been already related, in which a lunatic, in committing suicide, inflicted *thirty* wounds upon his head (p. 408). In a case of murder, when many wounds are found on a dead body, it may happen that the situation or direction of some will be incompatible with the idea of a suicidal origin. Thus a stab or cut may be close to a contusion or contused wound, and although a fall or other accident might account for the latter, the former would indicate violence separately inflicted.

Two or more mortal wounds.—When we find several wounds on the body of a suicide, it generally happens that one only bears about it a *mortal* character, namely, that which has caused death. On this account it has been asserted by some medical jurists, that when two mortal wounds are found upon a body, and particularly if one of them is of a stunning or stupefying tendency (i. e. affecting the head), they must be considered incompatible with suicide. An inference of this kind can be applied to those cases only in which the two wounds, existing on different parts of the body, were likely to prove immediately fatal. It must, however, be borne in mind, that all suicides do not *immediately* perish from wounds which are commonly termed mortal: on the contrary, they have often the power to perform acts of volition and locomotion, which might by some be deemed wholly incompatible with their condition. It is difficult to say whether one wound was likely to destroy life so rapidly as to render it impossible for the person to have inflicted another upon himself; but when there are several distinct incisions on the throat, each involving important blood-vessels, there is good reason to infer that they have resulted from an act of murder. There are no rules by which, in unknown cases, the instantaneous mortality of wounds can be accurately determined, a fact which will be apparent hereafter, from a description of wounds of the head, heart, and throat.

It is not possible to say, from the mere discovery of marks of contusion or injury on the head, that the deceased must have necessarily laboured under insensibility or concussion, and have therefore been afterwards unable to inflict any other wound upon himself. Injuries of the head are attended with the most singular anomalies in this respect. One person will be rendered insensible and powerless by a blow which may leave scarcely any appreciable marks, while another will be able to walk and exert himself when the skull has been fractured and depressed, blood effused, and even when a portion of brain has been lost: in short, the appearances may be such as to induce many surgeons to express an opinion that death must have taken place instantaneously. It is quite right that a medical jurist should be fully prepared for the occurrence of such anomalous cases, but a strong suspicion of homicide may fairly exist, when, besides marks of great injury to the head, a severe cut or stab is found on the body. A man is not likely to cut or stab himself after have sustained severe violence to the head; but he may retain the power of precipitating himself from an elevated spot, and thereby of producing great injury to the head, after having previously attempted to cut his throat or to stab himself.

A man was found one morning lying dead in a street in a low quarter of London, with his skull severely fractured, and his throat cut. The evidence adduced at the inquest satisfactorily showed, that the deceased had attempted suicide by cutting his throat in his bed-room, and had then thrown himself out of the window, by which the fracture and other severe contusions had been produced. Had his body been thus discovered in a lonely and sequestered spot, the medical presumption would certainly have been in favour of murder. Cases of this description are usually determined by circumstantial evidence. In the following instance there could be no doubt of homicide. A woman was found dead nearly twelve months after she was first missed. Her body was clearly identified. A handkerchief was drawn tightly round the neck, and a wound from a pistol-ball was traced through the left side of the chest, passing out at the right orbit; and three other wounds were found, one of which had entered the heart, and all of which had been made by a sharp instrument. The prisoner charged with the crime, alleged that the deceased had committed suicide—but the variety of the means and the instruments employed to produce death, as well as the fact that the gun-shot wound in the head, the stab in the heart, and the act of strangulation were individually sufficient to account for speedy death, left no doubt that this was an act of murder. (*The King* against *Corder*, Bury Summer Assizes, 1828. Will's 'Circ. Evidence,' 237.)

Wounds produced simultaneously or at different times.—When several wounds are found on a dead body, the question is frequently asked,—*Which was first received?* If one is what is commonly called mortal, and the others not, it is probable that the latter were first inflicted. This remark applies both to cases of homicide and suicide; but it is apparent that when, in a murderous assault, a person has been attacked by several assailants at once, the wounds may have been simultaneously produced. This is, however, a question to which it is not easy to give a specific answer. Each case must be decided from the special circumstances attending it; and in most instances, unless some direct evidence is forthcoming, a medical opinion can be little more than conjectural. I here refer to it, because it is a question almost always put in a Court of law; and a witness should at least prepare himself to meet it, by a proper examination of the medical circumstances of the case.

The case of *Reg.* v. *Spicer* (Berks Lent Assizes, 1846) affords an illustration of the importance of examining wounds minutely, as well as the locality where a dead body is found, when it is suggested that death has been caused by accident. The prisoner was charged with the murder of his wife, and the evidence against him was chiefly circumstantial. The deceased was found dead at the foot of a stair, as if she had accidentally fallen backwards. The parietal bone was fractured, and the fracture had extended to the base of the skull. The brain was lacerated, and there was great effusion of blood. The second vertebra of the neck was fractured, and the spinal marrow torn through. These injuries were quite sufficient to account for death, and had they existed alone, there might have been no reason to charge the husband with the murder. But there was a wound on each side of the temple, partly lacerated and partly bruised, and a branch of the right temporal artery had been divided—this injury having been inflicted, apparently, with a pointed blunt instrument. There were marks of blood on the wall at the top of the staircase, and a pointed stone, covered with blood, was found near to the body. It was therefore obvious, as the deceased had falled on the summit of the head, that the injuries to the two temples *laterally*, could not have been accidentally produced, for there was no projecting body against which she could have fallen in her descent to produce them; and when the force of the fall had been spent on the head, her body could not have rolled over so as to produce punctured and lacerated wounds on both temples. All the facts tended to show that a murderous assault had been made upon her at the top of the stair, and that she had afterwards fallen or had been pitched headlong backwards. The injuries received previously to the fall, might have stunned her, and might not have sufficed to account for death; but their nature and situation furnished strong proof that they could not have arisen from any accidental causes operating simultaneously, and that they were neither of accidental nor suicidal origin. The prisoner was convicted and executed. ('Med. Gaz.' vol. 37, p. 610.)

If several wounds have been inflicted through the *dress*, an examination of this may sometimes suffice to show which was first received. A man, in struggling with an assailant, received three stabs with a knife—two on the left elbow, and the third in the back. The latter was at about the level of the eighth rib;—it was vertical to the chest, and had clean edges. The lower margin was obtuse—the upper acute; hence it was evident that the cutting edge of the weapon had been directed upwards. It had traversed the left lung and the heart, and had caused immediate death. It was obvious, on examination, that this mortal wound had been first received, and the stabs at the elbow inflicted subsequently. These two stabs, which were slight, had divided the cloth coat and shirt, and had only grazed the skin, so that no blood had been effused. But the edges of the cuts in the cloth coat and shirt were stained with blood; hence it was evident that they must have been produced by a weapon already rendered bloody by a previous wound. The fact was of some importance in the case, and the correctness of the medical opinion was confirmed by the evidence at the judicial inquiry. (See 'Ann. d'Hygiène,' 1847, 1, p. 461.)

CHAPTER 35.

EVIDENCE FROM CIRCUMSTANCES—MEDICAL QUESTIONS—VALUE OF CIRCUMSTANTIAL EVIDENCE—THE POSITION OF THE BODY—OF THE WEAPON—THE WEAPON OR OTHER ARTICLES FOUND IN THE HAND OF THE DECEASED—EVIDENCE FROM BLOOD, HAIR, AND OTHER SUBSTANCES ON WEAPONS—HUMAN AND ANIMAL HAIR—MARKS OF BLOOD ON CLOTHING AND FURNITURE—NO BLOOD ON THE ASSAILANT—EVIDENCE FROM WADDING AND PROJECTILES—EXAMINATION OF FIRE-ARMS—BLOOD ON THE DECEASED—BLOOD ON THE ASSAILANT—EVIDENCE FROM THE FORM AND DIRECTION OF SPOTS OF BLOOD.

Evidence from Circumstances.—In pursuing the examination of the question respecting the homicidal or suicidal origin of wounds, the attention of the reader may be called to the force of evidence which is sometimes derived from the circumstances under which the body of a person, dead from wounds, is discovered. It may be said that this is a subject wholly foreign to the duties of a medical jurist, but I cannot agree to this statement. There are few in the profession who, when summoned to aid justice by their science, in the detection of crime, do not seek for circumstances by which to support the medical evidence required of them. A practitioner would certainly be wrong to base his professional opinion exclusively on these circumstances, but it is scarcely possible for him to avoid drawing an inference from them as they fall under his observation. His evidence may be of itself weak, and insufficient to support the charge against an accused party, in such a case, if any, suspicious circumstances have come to his knowledge, he may be often unconsciously induced to attach greater importance to the medical facts than he is justified in doing. In short, he may, through a feeling of prejudice, which it is not always easy to avoid, give an undue force to the medical evidence. But if a proper degree of caution is used in drawing inferences, and the circumstances are not allowed to create a prejudice in his mind against the accused, a practitioner is, I think, bound to observe and record them; for, being commonly the first person called to the deceased, many facts capable of throwing an important light on the case, would remain unnoticed or unknown, but for his attention to them. The position of a dead body,—the distance at which a knife or pistol is found,—the direction of the instrument,—whether situated to the right or left of the deceased,—the marks of blood or wounds about the person, or of blood on the clothes or furniture of the apartment, are facts which must assist materially in developing the real nature of a case, and in giving force to a medical opinion. Many of these circumstances can fall under the notice of him only who is first called to the deceased; and, indeed, if observed by another, no advantage could be taken of them, except from the interpretation of a medical man.

In the case of *Davidson*, who was tried for murder before the Aberdeen Spring Court of Justiciary, April 1855, the origin of certain wounds on the head of the deceased turned on the question of the presence or absence of nails at the head of a bed. On this occasion Lord Deas, the judge, remarked: 'A medical man when he sees a dead body should notice everything.' There was reason to believe that some nails had been driven into the head of the bed subsequently to the infliction of the violence, so as to give the appearance of the wounds having resulted from accident. There was some medical evidence in support of the view of their accidental origin, but according to Dr. Ogston there was no blood on the bedstock where the nails were represented to have been: and as the woman had died from bleeding, this was not likely to have escaped being stained with blood, if the wounds, as alleged for the defence, had really been produced by the nails. In his opinion, too, the nails would not have accounted for the wounds on the temple as the result of any accident. The whole of the difficulty in this case appears to have arisen from want of proof that there were no nails in the bedstock when the woman was found dead. The prisoner was discharged on a verdict of 'not proven.'

Among the questions which present themselves on these occasions are the following:—Is the position of a wounded body *that* which a suicide could have assumed? Is the distance of a weapon from the body such as to render it improbable that it could have been placed there by the deceased?—In answering either of these questions, it is necessary to take into consideration the extent of the wound, and the time at which it probably proved fatal. Again, it may be inquired—Has the deceased bled in more places than one? Are the streams of blood all connected? Are there any marks of blood on his person or clothes, which he could not well have produced himself? Are there any projecting nails or other articles which might account for wounds on the body as the result of accident? These are questions, the answers to which may materially affect the case: hence, a practitioner, in noticing and recording the circumstances involved in them, ought to exercise due caution. 'The consideration of the nature of circumstantial evidence,' observes Starkie, and of the principles on which it is founded, merits the most profound attention. It is essential to the well-being at least, if not to the very existence of civil society, that it should be understood, that the secrecy with which crimes are committed will not insure impunity to the offender. At the same time it is to be emphatically remarked that, in no case, and upon no principle, can the policy of preventing crime and protecting society warrant any inference which is not founded on the most full and certain conviction of the truth of the fact, independently of the nature of the offence and of all extrinsic considerations whatever. Circumstantial evidence is allowed to prevail to the conviction of an offender not because it is necessary and politic that it should be resorted to, but because it is in its own nature capable of producing the highest moral degree of certainty in its application. Fortunately for the interests of society, crimes, especially those of great enormity and violence, can rarely be committed without affording vestiges by which the offender may be traced and ascertained. The very measures which he adopts for his security not unfrequently turn out to be the most cogent arguments of guilt. On the other hand, it is to be recollected that this is a species of evidence which requires the utmost degree of caution and vigilance in its application, and, in acting upon it, the just and humane rule impressed by Lord Hale cannot be too often repeated: 'tutius semper est errare in acquietando quam in puniendo, ex parte misericordiæ quam ex parte justitiæ.' Admitting the truth of all that is here stated, it must be remembered that in some of the foulest murders the testimony of eye-witnesses has not been, and cannot be, forthcoming. 'Murders,' observes Lord Deas (Case of *McLachlan*, Glasgow, 1862), 'are not committed before people's eyes; and if it were necessary to have direct evidence of murder, it would be very easy to murder anybody without detection, and we might have a murder committed every day. That is not the law, and I do not think you (the jury) will be of opinion that that should be the law. The law is that facts and circumstances (whether medical or non-medical) put together may be so strong as to prove murder.' The facts and circumstances, of course, when thus put together, should admit of no reasonable doubt. Evidence is *direct* when a fact is proved by eye-witnesses, and *circumstantial* when the fact is proved by circumstances. More commonly it is *presumptive*, *i. e.* founded on an inference from circumstances.

The rule respecting the admissibility of this kind of evidence applies to circumstances of a *medical*, as well as those which are of a physical or moral kind. Medical circumstances, when properly observed and interpreted, are often of the highest importance. In order to convict an accused person on circumstantial evidence, the facts proved in the case should be consistent with his guilt, and be utterly inconsistent with his innocence; or, in the language of a learned judge, a certain number of material facts should be incontestably proved in the case, which are quite inconsistent with the innocence of the prisoner. These facts should be such as to render it impossible in the minds of the jury that any one but the prisoner could have committed the murder. The late Baron Alderson, in charging a jury to this effect, made an observation which should be remembered by medical witnesses, in reference to circumstantial evidence. He pointed out to them the 'proneness of the human mind to distort the facts in order to establish such a proposition (the guilt of the prisoner), forgetting that a *single circumstance* which is inconsistent with such a conclusion, is of more importance than all the rest, inasmuch as it at once destroys the hypothesis of guilt.'

There are many cases on record in which an observation of slight and unexpected circumstances by medical men, has led to the detection of offenders. In the life of Sir Astley Cooper, it is mentioned, that when called to see *Mr. Blight*, of Deptford, who had been mortally wounded by a pistol-shot in the year 1806, he inferred from an examination of the localities that the shot must have been fired by a *left-handed* man. The only left-handed man near the premises at the time was a Mr. Patch, a particular friend of the deceased, who was not in the least suspected. This man was, however, subsequently tried and convicted of the crime, and he made a full confession of his guilt before execution.

The rules for investigating a case of poisoning (see p. 152) may be equally observed in cases of death from violence. Among the circumstances to which a medical witness should specially direct his attention on these occasions are the following:—

1. *The Position of the Body.*—The body may be found in a position which the deceased could not have assumed on the supposition of the wound or injury having been accidental or suicidal. The position of a dead wounded body is often only compatible with homicidal interference, either at the time of death or immediately afterwards. In order to determine the probable time of death, we should always notice whether there is any warmth about the body,—whether it is rigid, or in a state of decomposition, and to what degree this may have advanced. The importance of such observations in a case of alleged murder has been elsewhere considered (p. 39).

2. *The Position of the Weapon.*—If a person has died from an accidental or self-inflicted wound, likely to cause death either immediately or within a few minutes, the weapon is commonly found either near to the body or within a short distance of it. If found near, it is proper to notice on which side of the body it is lying; if at a short distance, we must consider whether it might have fallen to the spot, or have been thrown or placed there by the deceased. If there has been any interference with the body, evidence from the relative position of it and the weapon will be inadmissible. In a case which was referred to me some years since, a woman had evidently died from a severe wound in the throat, which was homicidally inflicted; the weapon, a razor, was found under the left shoulder, a most unusual situation, but which, it appears, it had taken owing to the body having been carelessly turned over before it was seen by the surgeon who was first called.

It is compatible with suicide that a weapon may be found at some distance, or in a concealed situation; but it is much more frequently either grasped in the hand, or lying by the side of the deceased. In one instance, it is stated the deceased was discovered in bed with his throat cut, and the razor lying *closed* or shut by his side. In another case, the bloody razor closed, was found in the deceased's pocket. In the case of a *Captain Wright*, who was found dead in one of the French prisons (during the war with France), it is stated on good authority that the *razor shut*, was held in the hand of the deceased. In a wound involving the great blood-vessels of the neck, it is most improbable that there should be any power to close or shut the razor with which the wound was inflicted; and there are fair grounds to suspect interference when a razor is thus found closed in the hand. There is, however, one circumstance in relation to a weapon strongly confirmatory of *suicide.* If the instrument is firmly grasped in the hand of the deceased, no better circumstantial evidence of suicide can be offered. It is so common to find knives, razors, and pistols grasped in the hands of suicides, that it is quite unnecessary to produce cases illustrative of this statement. The grasping of a weapon appears to be owing to muscular spasm persisting after death, and manifesting itself under the form of what has been called cadaveric spasm—a condition quite distinct from rigidity, although often running into it. It does not seem possible that any murderer could imitate this state, since the relaxed hand of a dead person cannot be made to grasp or retain a weapon, like the hand which has firmly held it by powerful muscular contraction at the last moment of life. Of this the case of *Reg.* v. *Saville* (Nottingham Summer Assizes, 1844, and *Reg.* v. *Heywood*, Liverpool Winter Assizes, 1855), furnish an illustration. See pp. 24 and 25.

In reference to the weapon being found at a distance from the body, all the circumstances of the case should be taken into consideration before any opinion is expressed. If the weapon cannot be discovered or it is found concealed in a distant place, this is strongly presumptive of homicide, provided the wound is of such a nature as to prove speedily fatal. In the case of *Lord W. Russell*, 1840, no weapon could be found; and although the wound in the throat bore somewhat of the characters of a suicidal incision, the absence of the weapon was sufficient to show that a wound which was certain to be rapidly fatal, must have been the act of a murderer. The assassin had used a carving-knife which he had afterwards washed and then replaced in the tray with the other knives.

It will be proper to notice whether the weapon is sharp or blunt, straight or bent, also whether the edge is or is not notched. These circumstances may throw a light on the question of suicide or murder. In *Reg.* v. *Gill* (Dublin Commission Court, Nov. 1860), the prisoner, an old man, was charged with the murder of his wife. The woman was found dead with a wound in her throat which divided the larynx at the thyroid cartilage as well as the thyroideal arteries and gullet. It penetrated to the front of the spine, which was hacked and notched apparently with some violence. Several pieces of bone were detached. The right hand of the deceased was turned back, and a blunt knife was lying loosely in it, not grasped. The cut through the skin and muscles of the throat was clean and had evidently been made by a sharp instrument. On the left side the cut had two extremities presenting an appearance as if the weapon had been twice used in cutting. The knife found in the hand of deceased was not only blunt, but turned at the point, and it had no handle. There was a mark of a bloody finger on the dress over the left shoulder of deceased. From this state of facts, Mr. Porter and Dr. Geoghegan drew the conclusion that deceased had not inflicted this wound on herself. Among other circumstances the hacking of the spinal column and the evidence of two separate cuts were adverse to the theory of suicide. Further, the wound had not been made with the knife found in the hand. If this weapon had been used for the purposes of suicide, it would either have been grasped in or have altogether fallen out of the hand. The deceased had not produced the bloody mark of a finger found upon her dress. There could be no doubt of the correctness of these conclusions. A blunt knife had been substituted for a sharp razor; the placing the knife in the hand failed to give the appearance presented in suicide, and the nature of the wound was inconsistent with the idea of self-infliction. The prisoner was nevertheless acquitted.

3. *Blood on Weapons.*—The weapon with which a wound has been inflicted is not necessarily covered with blood. The popular view is that if much blood is found about a dead body, the weapon ought always to be more or less bloody. In reference to heavy blunt instruments applied with force to the head, severe contusions and fractures may be produced without immediate effusion of blood. Unless the bludgeon is used in a subsequent struggle or handled by a bloody hand, no blood whatever may be found on the end which produced the injuries. In reference to stabs, the knife is frequently without any stains of blood upon it; or there is only a slight film, which, on drying, gives to the surface a yellowish-brown colour. The explanation of these facts appears to be that in a rapid blow or plunge the vessels are compressed, so that a bleeding takes place only after the sudden withdrawal, when the pressure is removed. Even if blood should be effused, the weapon, in being withdrawn, is sometimes cleanly wiped against the edges of the wound, owing to the elasticity of the skin. Thus the first stab through the dress may not present any appearance of blood on the outside, but in a second stab, with the same weapon, the outside of the dress should present a bloody mark, unless the weapon had previously been wiped (p. 422). The blood may have been removed by washing from the blade of a knife or dagger. The handle and inner portions should therefore be closely examined. In a case of alleged murder (Nov. 1857), I found no blood on the blade of a knife or in the notch for opening it: but on removing the buckhorn handle, I found a coagulum of blood between this and the plate of iron to which it was riveted.

When a weapon is bloody, particular attention should be given to the manner in which the blood is diffused over it. In cases of imputed wounds, or in the attempted concealment of murder, it is not unusual for a criminal to besmear with blood a knife or other weapon which has probably not been used, and to place it near the body. A young man alleged that he had received a cut on the forehead by a blow from a cutlass, which he produced. It was observed by the late Dr. Marc, that the weapon was smeared with blood on both surfaces: but the layers were thicker towards the handle than at the point. The wound on the forehead was a clean incision; a cap, which the complainant wore, had been cut through. It was obvious, therefore, that the blood on the weapon could not have proceeded from this cut, for it would have been wiped, or only left in thin streaks, and more towards the point than the handle, by the act of drawing it through the clothes in producing the wound. There was no doubt that blood had been intentionally applied to this blade. ('Annales d'Hygiène,' 1829, vol. 1, p. 263.) In the case of *Doidge* (Cornish Summer Assizes, 1862), the weapon, a large cleaver, had been wiped on the smock of the deceased, but although the blood had been thus in great part removed from the surface of the blade, it had been wiped into the recesses of the letters of the maker's name, which were found to contain dried coagulated blood.

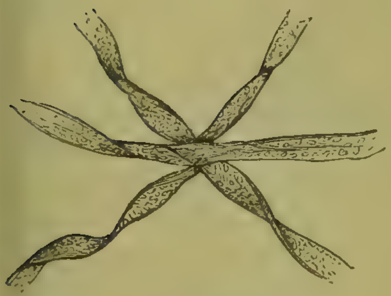
The blood on a weapon may be in a partly coagulated state, and not diffused as a mere film. This would render it probable that it had issued from the body of a living person or animal, or from a body recently dead. The blood of a *dead* animal dried in small spots on the blade of a knife may sometimes present a similar appearance, and thus lead to a mistake in evidence. This question arose in the case of *Reg.* v. *Nation* (Taunton Spring Assizes, 1857). Deceased was found dead in a cart with his throat cut, and there could be no doubt that this was an act of murder. The prisoner, who had been last seen in his company, was arrested, and a knife was found in his possession, on the blade of which there were marks of blood. On the part of the prosecution, it was contended that the knife had been used for cutting the throat of the deceased, while, according to evidence given for the defence, it had been used for cutting raw meat (beef). A chemical witness, who was called for the prosecution, stated that the knife had been immersed in *living* blood up to the hilt,—that it was *not* the blood of an ox or a sheep, and that there were on the blade of the knife certain scales or empty cells, such as are found in the mucous membrane of the throat (epithelial scales?). They were much larger than the globules of the blood, and were perfectly distinguishable by the microscope. From the appearance he thought the knife had passed through the mucous membrane which forms the lining of the throat! If this evidence was trustworthy there was an end of the defence; with the admission of the statement that there were scales of the mucous membrane of the *throat* (the gullet?) upon the blade, no further proof was required that the weapon had been used for cutting a throat. Fortunately, however, for the ends of justice, there were other circumstances which brought the crime home to the prisoner, and he was convicted. ('Med. Times and Gaz.,' April 11, 1857.) Cockburn, C. J., in commenting on these microscopic subtleties, said, 'In admitting the advantages of science, they were coming to great niceties indeed, when they speculated upon things almost beyond perception, and he would advise the jury not to convict upon this scientific speculation alone.'

4. *Hair and other substances on weapons.*—In some instances no blood may exist on a weapon, but a few hairs or fibres may be found adhering to it if the weapon is of a bruising or cutting kind. The main question may be, in such a case, whether the hair is that of a human being or of an animal. The importance of examining closely the hair found on weapons is shown by a case quoted by Dr. Lyons, in which a hatchet having clotted blood and hair adherent to it was produced as evidence against an accused person, under whose bed this weapon had been found. This, with other circumstantial evidence had turned public opinion strongly against the prisoner; but when the hair was examined it was found not to be human, but to have been taken from the body of some animal. This circumstance led to a more complete sifting of the evidence, and the accused was acquitted. It turned out that the accused had killed an animal with the hatchet, and had carelessly thrown the weapon under the bed. ('Apology for the Microscope,' p. 24.) In *Reg.* v. *Hansen* (Bodmin Lent Assizes, 1856) the weapon by which the deceased lost his life was a heavy stone found near the dead body. The base of the skull was fractured, and there were upon the stone marks of blood with some hair similar to that of the deceased. The prisoner was connected with the act by his having been seen with the stone or one closely resembling it in his possession. On these and other circumstances he was convicted.

Before any coagulated blood is removed from a weapon it should be examined carefully by the microscope. Hairs or fibres of linen, woollen, silk, or cotton, may be found imbedded in the solidified blood, either on the edge or on the blade; and evidence of this kind may occasionally be of great importance. In *Reg.* v. *Harrington* (Essex Lent Assizes, 1852), a razor was produced in evidence, with which it was alleged the throat of the deceased had been cut. I examined the edge microscopically, and separated some small fibres from a coagulum of blood, which, under a high magnifying power, turned out to be cotton fibres. It was proved at the trial that the assassin, in cutting the throat of the deceased while lying asleep, had cut through one of the strings of her cotton nightcap. This was a strong circumstance to show that the razor produced was the weapon with which the fatal wound had been inflicted.

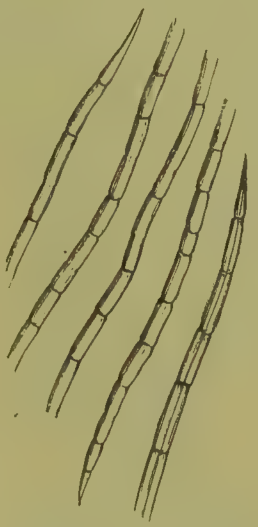
In *Reg.* v. *Steed* (Maidstone Summer Assizes, 1863), Dr. Pavy and I examined the boots of the prisoner who was charged with the murder of the deceased. The marks of violence about the head showed that the assailant had trampled on the deceased after he was on the ground, producing severe wounds, which led to his death. Some hairs were found firmly wedged beneath the large hobnails of the boots; and in certain dark stains of coagulated blood on the leather, there were some red woollen fibres. The hair was compared with a portion cut from the head of the deceased, and corresponded in colour and size. On inquiry it was found that at the time of his death deceased wore round his neck a red woollen comforter, of which the wool corresponded in colour and appearance with that taken from the prisoner's boots. The case was brought home to the prisoner by a variety of circumstances, all inconsistent with his innocence. I have elsewhere referred to the case of Cass (*Reg.* v. *Cass*, p. 413), in which the dried blood upon a knife lying near the body of deceased, was found on a microscopical examination to lock up within it certain fibres of woollen of a peculiar dark dye, resembling the fibres taken from a coat worn by the prisoner.

Fig. 1.



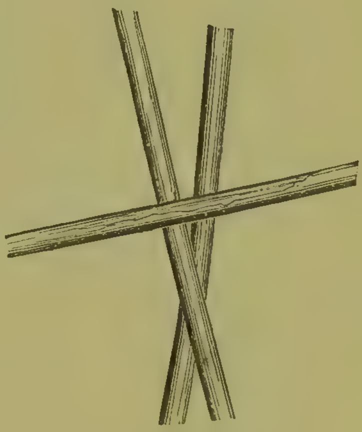
Fibres of Cotton, magnified 300 diameters.

Fig. 2.



Fibres of Linen, magnified 300 diameters.

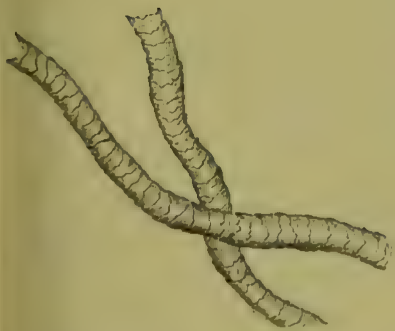
Fig. 3.



Fibres of Silk, magnified 300 diameters.

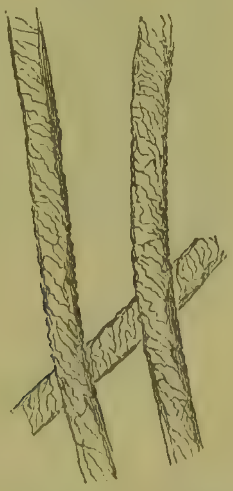
Fibres found upon weapons should, if adherent to coagula, be removed by

Fig. 4.



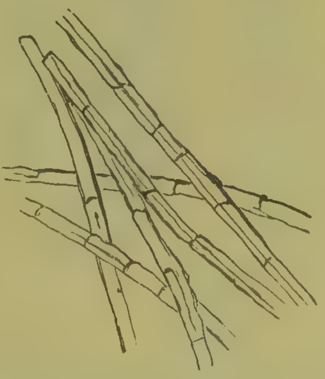
Fibres of Woollen, magnified 300 diameters.

Fig. 5.



Fibres of ancient Woollen, magnified 300 diameters.

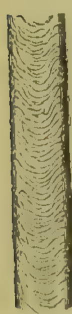
Fig. 6.



Fibres of ancient Linen, from an Egyptian Mummy, magnified 300 diameters.

careful digestion of the clot of blood in water, otherwise they may be at once examined in the dry state. A magnifying power of about 300 diameters may be employed. Under these circumstances *cotton* presents itself as a flattened band, assuming more or less a spiral form (Fig. 1, p. 429). The fibre of *linen* derived from flax is in a rectilinear form, with jointed markings at unequal distances, the fibre tapering to a point (Fig. 2). Silk and woollen have other characters by which they may be identified. *Silk* presents a regular cylindrical form, and there are no markings upon the surface. It has a strong refracting power on light, which gives to the fibre a well-defined boundary (Fig. 3). The fibre of *woollen* is irregular, contorted, of unequal thickness, and it has peculiar markings of an imbricated character on the surface (Fig. 4). This may be taken as the type of cloth, shoddy, alpaca, merino, and a variety of other fabrics worn as clothing. The microscopical characters of these fibres under certain circumstances are long retained, so that they may be identified after many centuries. Fig. 5 represents the woollen fibre from the shroud of a monk buried in an ancient priory in the fourteenth century, and exhumed within a recent period, after the lapse of five hundred years. The markings are simply less defined than in the recent sample of wool. The fibres are also of a coarser and larger kind. The fibre of linen appears to be equally indestructible. Fig. 6 represents fibres from the linen cerements of a mummy, of the dynasty of the Shepherd Kings. It was unrolled in 1832. This fibre is well preserved and is still tough. The ancient woollen is rotten, and breaks into small fragments. The linen has the characters of the fibre of modern flax. It is of a very coarse fabric, and is strongly impregnated with a brown bituminous matter used in embalming. Its preservation is no doubt in great part owing to the presence of this substance. The illustrations above given have been drawn from average specimens, under the same microscopical power, so that they are calculated to give an idea of the relative size of the fibres. (See on this subject Linde's 'Beiträge zur gerichtlichen Chemie,' p. 45, 1853.)

Other fibres are frequently found upon weapons, boots, and articles of dress. These are common vegetable fibres from roots, leaves, and other substances. They cannot be confounded either with hair or with the four sorts of fibres above described. The discovery of *hairs* upon weapons or clothing may have an important bearing on medical circumstantial evidence. The character of human hair is pretty well marked at all ages. In the young and in females it is long and fine. The hair of the head presents itself in transparent cylinders, variously coloured, with markings resembling those of wool, but hair is more uniform in width. It has a cortical and medullary portion. In the annexed illustration Fig. 1 represents the hair of a child, magnified 300 diameters, with the linear markings on the cortical portion. Fig. 2 represents the hair of an adult, magnified 300 diameters. The lines are equally seen on the cortical portion,—the dark shading in the centre represents the situation of cells which traverse the centre of the medullary portion. The figure *a* is a transverse section of the hair, showing the cortical and medullary portion, and the air-cells in the centre of the cylinder. These hairs were found on measurement to have a diameter of 1-360th of an inch. Human hairs vary much in size,—some do not exceed the 1-600th of an inch. Fig. 3 represents the pointed extremity of the hair of the eyebrow. These hairs, like those of the eyelashes,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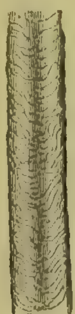
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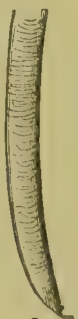
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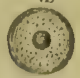
a

are coarser and thicker than those of the head, and are opaque, except near the point, where they become transparent, as shown in the illustration. In examining hairs microscopically it will be well to observe whether they are of the same or of different colours, or sizes, whether they are pointed at one end or cut at both ends, and whether they have still attached to them, the bulb or sheath in which they grew. The annexed engraving, Fig. 4, represents the sheath of the hair with the hair issuing from it. This condition of the hair will be found when it has been violently torn from the skin. The microscope will sometimes enable a medical jurist to state whether a hair has been indented, cut, or bruised, at either or both ends,—the medullary structure frequently retains these marks of violent treatment. (See Casper's 'Vierteljahrschrift,' Jan. 1863, p. 76.) The hairs of animals are frequently found on weapons and clothing: they must not be confounded with human hair. They are generally speaking coarser, shorter, thicker, and less transparent than those of a human being. The hair of some animals may be at once distinguished by the eye or by a pocket lens, as that of the cow, the horse, and the deer; but the hair of some dogs, such as the Skye-terrier and spaniel, closely resembles that of man. It is long and silky. The linear markings on the cortical portion are not so numerous or fine. Fig. 5 is the hair of a spaniel magnified 300 diameters. By measurement it had a diameter of the 1-1125th of an inch. Fig. 6 is the hair or fur of the rabbit, 1-1125th of an inch. Fig. 7 the hair of the hare. These hairs have a remarkable structure, in the form of transverse cells. This kind of hair is found in all the rodentia, *i. e.* the rat, the mouse, and the squirrel. Fig. 8, the hair of the horse, 1-340th of an inch. Fig. 9, of the goat, 1-500th of an inch. Fig. 10, of the fox, 1-600th. Fig. 11, of the cow, 1-600th of an inch. Fig. 12, the hair of the fallow-deer, 1-250th of an inch in diameter. The mere difference in size among these hairs is not to be regarded as a marked distinction, for in the same animal, hairs of very different sizes may be found. The engravings above given have been accurately copied from actual specimens measured at the time of observation. They are all represented under the same magnifying power, *i. e.* 300 diameters. The cells and linear markings on the cortical portion furnish the most striking differences. The necessity for an acquaintance with the character of hair will be apparent from the case of Teague (*Reg.* v. *Teague*, Cornwall Summer Assizes, 1851). This case has been elsewhere referred to (p. 400). It was alleged that the fatal wounds to the head of deceased, involving both eyebrows, had been produced by a hammer

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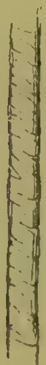
Human Hair, with tubular Sheath, as torn out by force, magnified 70 diameters.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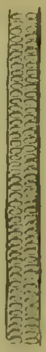
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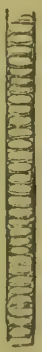
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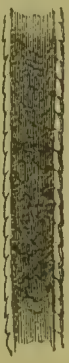
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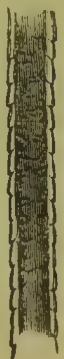
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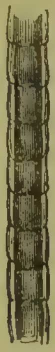
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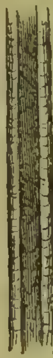
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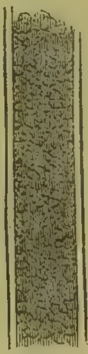

12

found on a hedge. There was no blood on the hammer, but there were two short white stiff hairs at the smaller end. It was suggested that these might have been the hairs of a white goat, the hammer having been used for beating out portions of goat-skin which were hanging on the same hedge. Two medical witnesses, however, deposed that they were hairs from a human eyebrow, and having compared them with deceased's eyebrow, they found they agreed. The hair of the eyebrow was described as conoidal or pyramidal: and the hair on the hammer had this character. It appeared as if it had been bruised or squeezed between two blunt substances, but this appearance might have been equally presented on the theory of the defence, that it was goat's, and not human hair. Assuming the medical evidence to be correct, it pointed to the weapon, and not to any act on the part of the prisoner. The witnesses were severely cross-examined upon the structural differences of the hair of man and animals. ('Med. Gaz.' 1851, vol. 48, p. 731.)

It will easily occur to a medical jurist that, on some occasions, this kind of evidence will be of importance in showing that the hair is similar to or different from that of the assailant or deceased. An opinion of identity based on a similarity of hairs found on a weapon or on a person who has died from violence, should be expressed with caution. There are many persons who have hair similar in colour, size, and length; hence a witness may be able to say that there was similarity, but he can rarely be in a position to swear that there is absolute identity. In *Reg.* v. *Devine*, March 1864, the deceased was killed by blows with a poker. On the end of the weapon, which was traced to the prisoner, some grey hairs were found, corresponding to those of the deceased. In a case of murder and suicide which occurred at Somers Town in July 1864, Dr. Harley found on a hatchet certain hairs from one to three and a half inches long, which he described as human hairs from the head of a fair person who was becoming grey. From their fineness he considered them to be hairs from the head of a woman, and when compared with those taken from the head of the deceased female (*Rosetta Bishop*), they presented so great a similarity as to leave no doubt that the hair had belonged to the same person, and that the wounds on the head had been inflicted with this hatchet. As in other cases of contused wounds on the head, there was no blood upon the hatchet. The presence of hairs on a weapon under these circumstances proves that it has not been washed, or they would not be found; and if with the hairs there is no blood, then it follows that these could not have been stained with blood from the wound. This absence of blood is, however, quite consistent with the production of contused wounds from which blood may have subsequently escaped in large quantity. (See page 427.)

5. *Foreign Substances in wounds.*—In gunshot wounds, the examination of wadding or paper found in a wound or near a dead body has in more than one instance led to the detection of the person who had committed the crime. His handwriting has been traced on the paper used as wadding, or it has been found to have been part of a printed page, of which the remainder has been discovered in his possession. When a gun is discharged near to the body, a portion of the wadding is generally carried into the large irregular wound which is produced. This was part of the evidence in the case of *Reg.* v. *Blagg* (Chester Summer Assizes, 1857). The peculiar character of the wadding found in the body connected the prisoner with the act. Whether the wadding is found in or near the body, it should be equally preserved. In *Reg.* v. *Richardson* (Lincoln Assizes, Dec. 1860), the accused was convicted of murdering a policeman under the following circumstances. He shot at the deceased, who was able before death to identify the prisoner; but as the deceased was weak from loss of blood and failing in consciousness at the time, there was some difficulty in relying upon this dying declaration,

especially as no other person witnessed the act. Some paper-wadding had been picked up on the spot where the deceased fell; and a gun which had one barrel loaded and one empty from a recent discharge, was found in the prisoner's house within twenty-four hours of the murder. The wadding in the loaded barrel consisted of a fragment of *The Times* newspaper of the 27th of March 1854, and the charred and sulphurous pieces of wadding picked up on the spot were proved by the publisher of that journal, who was summoned on the trial, to have formed a portion of the same impression. The prisoner's counsel, in fact, though he contended with marked ability for the innocence of his client, could not deny that the act had been brought home to the instrument, if not to the agent, and though the explanation of the crime remained obscure to the last and the motive unassignable, the aggregate evidence proved sufficient to convince the jury. Any projectiles found in a gunshot wound should always be preserved for evidence. In the case of *Rush*, who was tried and convicted of the murder of Mr. *Jermy* by a remarkable train of circumstantial evidence (Norwich Lent Assizes, 1849), it was proved that the projectiles removed from the body of the deceased, consisted of irregular pieces of lead (slugs). Similar masses were taken from the body of the son, who was killed at the same time. They were described by the medical witness as being angular, and quite unlike the shot used in killing game. Each piece weighed from eleven to thirteen grains, and there were fifteen pieces in all. As the learned judge remarked, this demonstrated that the two acts of murder were committed by the same person, or by this person acting in concert with others. In the *Queen* v. *Lloyd* (Shrewsbury Lent Assizes, 1854), it was proved that the deceased had been killed by the discharge of a gun through a window. He was struck on the head by about thirty shots, one of which had penetrated the brain and caused death. The assailant was not seen, but the charge was brought home to him by numerous circumstances: among others by the discovery in one of his pockets of shot of the same sizes as those removed from the head of the deceased (Nos. 3 and 4). The surgeon had very properly removed and preserved the shot, so that they were afterwards available as evidence against the prisoner. Facts of this kind may sometimes establish the innocence of suspected persons. In August 1859, a man was shot at Sheffield while sitting in a room. He was wounded in the left temple, and the ball lodged behind the left eye. A man was arrested on suspicion, and on searching his house two pistols were found, one a small one, and the other several sizes larger. As the ball could not be removed and the wounded man survived, no comparison could be made. In the meantime the prisoner was remanded. The wounded person died in March 1860, from the effects of the injury. The ball was then extracted from the body and compared with the pistols. It was too small for one and too large for the other, so that it could not have been fired out of either. The man was discharged. The chemical analysis of a projectile may be occasionally necessary. A common bullet is entirely formed of lead. Cast bullets are commonly found to have a void space in the interior when cut through the centre, owing to the exterior cooling more rapidly than the interior, and to the greater bulk of the metal when in a liquid state. In large bullets this cavity is frequently of the size of a barleycorn. Bullets obtained by compression have no such space, and are of greater specific gravity. Small-shot consist of lead with a minute fractional portion of arsenic (1-200th part). If the arsenic is in large proportion the shot is lenticular; if absent or in small proportion, pyriform (Ure). In the case of *Rush*, type-metal was found in the house. This consists of lead with one-fourth part of antimony, the latter being left by digestion in nitric acid. It was therefore considered advisable to examine the slugs chemically, and they were found to consist chiefly of lead, and to contain no antimony.

Examination of Fire-arms.—An attempt has been made by French medical jurists to determine for how long a period a gun or pistol found lying near a dead body may have been discharged; but it is out of our power to lay down any precise rules on such a subject. All that we can say is, a quantity of sulphide of potassium, mixed with charcoal, is left adhering to the barrel of the piece, when *recently* discharged; and this is indicated by its forming a strong alkaline solution with water, evolving an odour of sulphuretted hydrogen, and giving a deep-brown precipitate with a solution of acetate of lead. After some hours or days, according to the degree of exposure to air and moisture, the saline residue becomes converted into sulphate of potash, forming a neutral solution with water, and giving a white precipitate with acetate of lead. If a considerable time has elapsed since the piece was discharged, oxide of iron with traces of sulphate may be found. (See 'Ann. d'Hyg.' 1834, 458; 1839, 197; 1842, 368.) This subject excited some attention at a trial which took place in France in reference to the death of M. *Dujarrier.* It was considered here of some importance to determine whether, by the mere discharge of powder, such a deposit of charcoal or powder took place at the mouth of the pistol, as to soil the finger when introduced three hours after the alleged discharge. M. Boutigny conducted the investigation, and found in his experiments that the finger was not blackened under the circumstances. He considers that sulphate and carbonate of potash are formed, and that the charcoal is entirely consumed. The facts proved at the trial were, however, adverse to the view thus taken; and it really appears that this most elaborate enquiry, involving physics, chemistry, and mathematics, might have been spared, on the simple ground that the result produced by a discharge of powder in the way supposed, must depend on the quantity of powder employed, its perfect or imperfect combustion, and the proportion of charcoal contained in it. The elements for solving such a strange pyrotechnic question must therefore in most, if not in all cases, be wanting. ('Ann. d'Hygiène,' 1848, 1, 392.)

Foreign substances are sometimes discovered in contused or lacerated wounds: and these may throw an important light on the circumstances under which a crime has been perpetrated. In *Reg.* v. *Hazell* (Taunton Lent Assizes, 1848), the body of the deceased was found in a well. When examined, there were on the head several severe wounds quite sufficient to account for death. There was much blood on the clothes and face, and in the blood were sticking a quantity of hay-seeds, which led the medical witnesses to consider that the wound must have been inflicted in a stable, or in some place where there was hay. On examining a neighbouring stable, the spot where the murder was committed was rendered evident by the discovery of marks of blood.

There may be found in the wound a portion of the weapon itself. The preservation of this is necessary, as it may serve to connect the prisoner with the act, should his criminality be otherwise doubtful. In *Reg.* v. *De Salvi* (C. C. C. October, 1857), it was proved that the deceased died from a stab inflicted on him by the prisoner. Two inches of the pointed portion of the blade of a knife were found imbedded in one of the vertebræ. The spinal cord had been divided, and paralysis ending fatally was a result of the wound. The identity of the weapon was not only established, but the force with which it had been used by the prisoner, was clearly indicated.

In the case of a man named *Moore*, charged with murdering his wife in Finsbury, in December 1859, it was proved that the woman's throat had been cut through to the spinal column. The surgeon in making a minute examination of deceased's neck, found imbedded in the muscles and bone, small particles of steel, evidently broken off the edge of a cutting instrument. These were examined microscopically and their nature verified; they were covered with blood. In a box in the prisoner's room two razors were found. The blade of one of these was stained with blood from end to end,—it had been partly wiped. The edge of this razor presented several notches, corresponding to the portions of steel found on the neck-bone of deceased. The handle of the razor was also partly unriveted, showing that it had been used with great force. Suicide was not only thus disproved, but the act of murder was fixed upon the accused.

Marks of Blood on Clothing or Furniture.—It is proper to notice all marks of blood on the clothes of the deceased or in the apartment, and to observe where the greatest quantity of blood has been effused: this is generally found in the spot where the deceased has died. The deceased may have bled in more places than one; if so, it is proper to notice whether there is any communication in blood between these different places. Blood on distant clothes or furniture will show whether the deceased has moved about, and whether he has struggled much after receiving the wound. Acts of locomotion by a wounded person who has died from loss of blood, or by a criminal whose hands and feet may be bloody, are generally indicated by tracks or marks of blood. The observation of these marks is of medical importance at the time that a dead body is found. They may be so situated as to show that the body has been moved or been interfered with after death, and thus throw a light upon the question whether the act has been one of homicide or suicide. In *Reg.* v. *Hatto* (Bucks Lent Ass., 1854), a mark of blood, as from the smear of a hand, was traced along the passage of the house in which the body of the deceased was found. The mark was continued over the door-post into a back room, which was found locked and bolted on the inside. The crime was thus fixed upon the prisoner; for no one breaking into the house in front could have had access to this room. The evidence thus brought against him was derived from his feeling his way with a bloody hand in the darkness after the murder. He was not at the time aware that he was thus leaving impressions which would show that no one but himself could have perpetrated the crime. It is a fair subject of medico-legal inquiry on these occasions, whether there are any marks of blood about the apartment or the spot where a murder is alleged to have been perpetrated, which no one but the assassin could have produced.

In the case of Mr. Briggs (*Reg.* v. *Müller*, Central Crim. Court, October 1864), it was proved that the outside handle of the carriage door in which the fatal assault was made, was marked with blood, while there was no blood upon the hands of the deceased which were examined soon after the occurrence. This was adverse to the theory that deceased had opened the door, while it proved that a hand stained with fresh blood had been in contact with it.

In the case of Mrs. McPherson (the *Queen against Jessie McLachlan*, Glasgow Circ. Court, Sept. 1862), Dr. Macleod observed footprints in blood in the bedroom of deceased, who was found dead from wounds obviously homicidal. There were three, all the imprints of a naked left foot, one of them particularly well marked. That was the impression of a small well-formed foot at rest. Before any suspicion was attached to any one, the witness expressed an opinion that they were made by a female foot with a high instep. At the time of this act of murder, there were only three persons in the house,—the prisoner, the deceased, and a man aged 87, James Fleming. Dr. Macleod observed, when he made an inspection of the body, that there was no blood on the feet of the deceased,—further, he made a careful outline of her left foot, and found that it did not in any way correspond to the footprints. The foot of deceased was larger in all dimensions, it was longer and broader, and had a large bunion. In his opinion the left foot of deceased could not have produced the marks. He compared the foot of James Fleming with the footprints, and they were obviously quite different. He had a flat foot, in contradistinction to a high sole by which the marks had been produced. He was quite satisfied that the old man's foot could not have caused them. He also compared the feet of the prisoner with these marks, especially the left foot, and the marks in his judgment might have been produced by her foot. The accused made no objection to tread with her left foot in a thin layer of bullock's blood and then step on a plank of wood. When all the conditions of the floor were imitated, two impressions were obtained which corresponded with a marvellous degree of accuracy with the marks taken from the house. In the minutest detail of measurement and outline they tallied with the original. ('Report of Medical Evidence,' by Dr. Macleod, 1862, p. 13.) This was one among the numerous circumstances which tended to fix the act upon the prisoner.

Criminals sometimes show great anxiety to supply evidence, in order to avert suspicion from themselves. In *Gardner's* case (p. 40) it was remarked by the surgeon that there was no blood on the wainscot or part of the bed-furniture of a room where, had the woman Humbler perpetrated or participated in the act, it was supposed it would be found. On the following day some blood was pointed out in this situation by the prisoner; it had the appearance of having been recently smeared. This had been obviously done to furnish that evidence against the woman by which the prisoner hoped to avert suspicion from himself. Fortunately the room had been well examined on the previous day by the surgeon and a policeman, and they were able to depose that the marks of blood in the room had been caused subsequently to the first examination. The evidence thus supplied was therefore against himself, and in favour of the woman whom he accused.

In reference to clothing, it is advisable, if it be possible, to have some clear proof that the clothes sent for examination were actually worn by the accused, or belonged to the deceased. Serious mistakes are sometimes made, and opinions should therefore be expressed with caution. In the case of *Hatto* (Bucks Lent Assizes, 1854), the clothes said to have been worn by the prisoner on the night of the murder were sent to me for examination. On the shirt there were no marks of blood: on the trousers and cap there were a few stains of blood: but it was admitted that, from the appearance of these, they might have been on the clothes five or six weeks, and therefore several weeks prior to the date of the murder. Owing to this want of certainty respecting date, these clothes were not produced in evidence; and it subsequently turned out by the confession of the prisoner, and the discovery of other articles of dress in places where he admitted he had concealed them, that the clothes which had been examined were not worn by him when he perpetrated the murder. In the case of *Munro* (Cumberland Spring Assizes, 1855), the clothes supposed to have been worn by the prisoner were also sent to me for examination. There was no blood on the trousers, and it appeared from the evidence given at the trial, that the prisoner had changed this article of dress before he was apprehended.

It is proper to observe on these occasions whether the blood is deposited in large patches on clothing, or whether it is sprinkled, and also to make a note of the quantity. The sprinkling may have proceeded from a wounded artery or from a splashing of blood as a result of continued violence. We should likewise notice whether, if the wound is in the throat or chest, blood has flowed down in front of the clothes or person, or whether it has flowed so as to collect in the armpits, or on each side of the neck; for these appearances will sometimes show whether the wound was inflicted when the person was standing, sitting, or lying down. If the throat is cut while a person is lying down, it is obvious that the blood will be found chiefly on either side of the neck, and not extending down the front of the body. Few suicides cut the throat while in a recumbent posture, and the course which the blood has taken may, therefore, be sometimes rendered subservient to the distinction of a homicidal from a suicidal wound. The position in which the body was when a wound was inflicted, is a frequent question on inquests and criminal trials. In the case of *Lord William Russell* (*Reg.* v. *Courvoisier*, C. C. C. 1840), the throat had evidently been cut while the deceased was lying in bed ; the blood was effused on each side of the neck only. There was also found a wound on the thumb of the right hand of the deceased, which was probably inflicted at the time the hand was put up to defend the throat. The case of Mrs. *Gardner* (*Reg.* v. *Gardner*, C. C. C. Oct. 1862), already referred to as illustrating other important medico-legal points (see pp. 24, 40), bears a strong resemblance to that of Lord W. Russell, but the proofs of murderous interference with the deceased were still stronger. Her throat had been cut while she was in the recumbent position. Mr. Sequeira, who made the examination, found an impression made by sooty fingers on the inside of the left wrist, and a similar sooty impression on the left elbow, as if it had been forcibly grasped. On the inside of the right thigh there was the impression of the palm of a bloody hand of full size, pointing downwards. He noticed these marks before the prisoner, who was a chimney-sweep, had entered the room, and he also observed that there was no soot on the hands of the deceased, and no blood sufficient to produce such an impression of blood as that existing on the right thigh. The impression was also larger than the hand of the deceased.

In a case of fratricide referred to Dupuytren, the deceased had received a severe wound at the lower part of the neck, and another in the front of the chest, which had led to his death. As the blood had run down the front of the person from both of the wounds, and one of them was so deep that the deceased, unless supported, would have probably immediately fallen, M. Dupuytren inferred that two persons had been engaged in the murder, and that one held the deceased by the arms while the other struck him in front. This suspicion was corroborated by there being no marks of wounds upon the hands. The opinion thus expressed was singularly confirmed by the evidence adduced at the trial of the murderer. ('Ann. d'Hyg.' 1829, 1, 465.) If the deceased has been wounded with his clothes on, we should notice whether any part of his dress has or has not been cut or injured over the situation of the wound: whether the cut portions of dress are bloody, and whether the blood has been effused or applied on the *inside* or *outside*. When, together with a wound in the throat, we find the cravat and the shirt, or in a female the collar or bonnet or cap-ribbons cut through, this, all other circumstances being equal, is strongly presumptive of homicide. A person intending suicide, unless labouring under confirmed insanity, would not allow any mechanical obstacles of this kind to remain as an obstruction to the use of the weapon. In a case of homicidal wound of the throat, inflicted in the recumbent posture, the cravat of the deceased had been lifted up, and afterwards allowed to drop over the wound in order to conceal it. The importance of examining the dress, and comparing it with the marks of violence on the body, has already been pointed out.

When the carotids and all the soft parts of the neck have been divided and the amount of blood on the spot where the body is found is small, there is reason to infer that the act is homicidal, and that the wound may have been produced soon after death from some other cause of violence. The *Road murder* (Trowbridge, June 1860), in which a child, æt. 4, named *Francis*

Saville Kent, was destroyed, furnishes an illustration of this kind. In reference to children of this age, the question of self-infliction cannot be raised to embarrass the case. The murder appears to have been committed some time in the night of the 29th of June 1860, or in the beginning of the morning of the 30th of June. The dead body was found in a privy in the garden, wrapped in a blanket, which had been abstracted from a crib in which the child slept. The child appeared to have been prevented from falling down the privy by a splashing board upon which the body was lying with the throat cut. Upon the blanket, and a piece of flannel which was underneath, there was not that quantity of blood which might have been expected from such a wound. There were only two tablespoonfuls of blood and a few spots on the floor of the privy. This was coagulated, showing that it had come from a living or a recently dead body. On examining the body, Mr. Parsons, the surgeon, found two superficial cuts on the left hand. The throat was cut from ear to ear. Every structure down to the spine was severed. He also found a stab made by a long and strong instrument, which passed through the cartilages of two ribs, the diaphragm or midriff, and wounded the external coat of the stomach. This wound might have been made by a dagger or pointed knife. The viscera were in a perfectly healthy state. Death had taken place for at least five hours before he saw the body. This would bring the time of the murder to about three o'clock in the morning. He expressed his opinion that sufficient blood had not been discovered to account for death from the wound in the throat. There was a blackened appearance round the mouth of the deceased, such as is not usually seen in dead bodies. This, in his opinion, rendered it probable that the child had been suffocated or strangled before the throat was cut. No weapon was found near the body, but a piece of bloody paper was lying outside of the privy. The condition of the house was this :—Every door and window had been carefully fastened over night; the drawing-room window had been secured and the door locked; but in the morning this window was partially open and the drawing-room door unlocked. There was no appearance of any entry from without, or of any violence. Hence it was inferred that the door had been unlocked, the shutters unclosed, and the window opened, by some one within the house. It appeared that Mr. and Mrs. Kent (the parents of the child) occupied one bed-room, and a little girl, about five years of age, slept in the same room. In another room slept the two elder daughters, 25 and 26 years of age, who occupied one bed. In a third room slept another daughter, Constance, aged 15 years. In a fourth slept a lad, aged 14 years. In the nursery there was the nurse with two children, one of whom, almost a baby, slept in a cot by the nurse's bedside, and the other was the boy who was murdered, and who was placed in a crib a little way from her bed. There were two servants, a cook and housemaid, who were on another floor. The nurse who had had special charge of the deceased stated at the inquest that she first missed him from his bed at five o'clock in the morning, but she then gave no alarm. Although a light sleeper, she heard nothing during the night. There was no blood in or about the crib, and the bed-clothes were placed neatly, as if smoothed by a female hand accustomed to children. There was a watch-dog loose at the back of the premises, but the animal was not heard to bark during the night.

The circumstantial evidence entirely pointed to this act of murder having been perpetrated by some one who slept in the house that night, and there was reason to believe that two persons had been concerned in the matter. Out of ten individuals in the house, one was a baby. With respect to the other nine, three only slept separately,—a girl of 15, a boy of 14, and the nursemaid who was sleeping in the room close to the crib from which the deceased was taken. The remaining six slept two in a bed in different rooms, so that, although possible, it was not probable that one could have perpetrated the act without the cognizance of another. No bloody weapon was found, and no bloody clothing was traced to the possession of any one of the inmates. Whether there were the marks of blood on the opened window and shutter did not transpire in evidence. All denied any knowledge of or participation in the act. In spite of a full investigation of the subject, the perpetrators could not be traced. This has been regarded rather as a slur upon our criminal procedure, but slight reflection will show that the legal rule that no person can be examined as to his participation in an act of murder, must be a bar to the detection of the culprit where circumstantial evidence fails to point to one person more than another.

One of the learned judges before whom this case was argued in November 1860, said that he would give no sanction to calling upon suspected persons to account for themselves. Further, it is a rule that if of two or more persons one has been guilty of murder, but it is impossible to point out which, both must be acquitted. In France, the perpetrator of such an act would have been discovered, but it is considered in this country to be far better for society that a crime of this atrocity should escape detection and punishment, than that any suspected person should be required, even by the most restricted cross-examination, to furnish proofs of his guilt.

It is the practice in Scotland to examine a prisoner charged with murder. According to an eminent Scotch judge (Lord Deas), 'a prisoner when so examined may decline to answer any question, but to an innocent person it may and must be a very great privilege to be allowed to give an explanation of any circumstances which seem to be dark and suspicious against them.' ('Report of trial of Mrs. *McLachlan* for the murder of *Jessie McPherson*,' Glasgow Circuit Court, Sept. 1862, p. 145.) It is hard to see how any really innocent person can suffer from such a practice, but it is easy to perceive that when not adopted, not only may the murderer remain undetected, but the suspicion of participation in the crime may be fixed for life upon one or more innocent persons, who may have been on the premises at the time of the act. The case of Mrs. *McLachlan* affords an illustration of this. The prisoner when examined, made before her trial declarations exculpating herself, and implicating an aged man of 87 years in this act of murder. The statements which she made were not only inconsistent with the proved medical and other facts of the case, but inconsistent with each other. After a lengthened trial and much controversy, it was conclusively shown, chiefly from her own statements, that this woman alone was guilty. Subsequently to her conviction, another statement was made by her which gave an entirely different version of the facts. This was clearly constructed to meet the difficulties of her case as they were proved at the trial, and they combined such a mixture of truth and falsehood as for some time to deceive a section of the public. Had this murder been perpetrated in England, it is probable, from the difference in the English practice, that to this day it would have remained in the same state of doubt and mystery as the Road murder,—the criminal would have escaped, and a suspicion would have been fixed for life on those who were innocent.

When spots of blood are found upon articles of dress or furniture, their *form* and *direction* may occasionally serve to furnish an indication of the position of the person with respect to them when the wound was inflicted. Thus, if the form of a spot is oval and elongated, the presumption is that the person was placed obliquely with respect to the stained furniture, during the hæmorrhage. ('Ann. d'Hyg.' 1840, p. 397.) The force with which the blood has been thrown out, will be in some measure indicated by the degree of obliquity and length of the spot This is in general wide and rounded at the upper part, but narrow and pointed below. The case of *Spicer* furnishes some suggestions on the importance of evidence occasionally derived from an examination of the form and direction taken by spots of blood. At the top of the stair, and at the height of four or five feet above the level, several spots of blood were observed upon the brick wall. (See illustration, page 452.) These were rendered evident by the wall having been recently whitewashed. The spots took an oblique direction from above downwards, were of a pale red colour at the upper part, but dark red below, terminating in a point consisting of the fibrin and the greater part of the red colouring matter. Their form and regularity proved that they had proceeded from a small artery, and that the wounded individual could not have been very distant from the wall, while their shining lustre rendered it probable that they were of recent origin, and their well-defined termination in a firm coagulum, showed that they had probably proceeded from a living blood-vessel. The deceased had died from fracture of the skull and vertebral column by a fall from the top-stair; one branch of the right temporal artery was found divided, and this wound could not have been produced by the fall. It was therefore evident that a murderous assault had been made upon the deceased at the top of the stair, and this had led to the spurting of the arterial blood on the brick. The height at which the spots existed, and their appearance, proved that the jet of blood had been from above downwards; thereby rendering it probable that deceased was standing up, or that her head was raised at the time the wound was inflicted. Further, as the brick with the spots was on the left hand in the descent, and the wounded artery was on the right side, it is probable that deceased was face to face with her assailant in the act of ascending the stairs, and that she was killed by being precipitated backwards to the bottom. The position in which the body was found in the cellar corroborated this view. ('Med. Gaz.' vol. 37, p. 612.)

In examining a dead body, attention should be paid to the state of the *mouth* and *throat*. Assailants who make their attack during sleep, sometimes endeavour to close the mouth, or to compress the throat, so as to prevent an alarm being given. In the case of the *Duchess of Praslin*, there were the marks of finger nails around the mouth. In another case, ecchymosed impressions, as if produced by a hand, were found upon the throat of the deceased. The *hands* of the dead person should always be examined; many cuts, excoriations, or incisions found upon them, especially if on the dorsal surface (back), will indicate that there has been a mortal struggle with the assailant. In the inspection, the examination of the *stomach* should not be omitted. The presence or absence of food, mucus, or blood, may furnish evidence of considerable importance in the elucidation of the case. Thus, in the stomach of the *Duchess of Praslin*, a quantity of bloody froth was discovered. This rendered it certain that she had lived sufficiently long to swallow a quantity of saliva mixed with blood, and that probably she had made some attempts to give an alarm. The fact that several days have elapsed, since death will not prevent the discovery of food in the stomach, provided it has been taken within one or two hours before death: since the digestion of food does not appear to go on to any perceptible extent after death. I have thus discovered food in the stomach twenty-eight days after interment. This question connected with the digested or undigested state of the food found in the stomach, frequently arises on criminal trials.

The nature of the dried spots of *mud* on clothing may occasionally serve to connect an accused person with an act of murder. In the case of the *Queen* v. *Snipe and others* (York Winter Assizes, 1852), evidence was adduced to show that some spots of mud on the boots and clothes of the prisoner, when examined microscopically, presented infusorial shells, and some rare aquatic vegetables, particles of soap, confervæ, and hairs from the seeds of groundsel. The mud of a ditch close to which the body of the deceased was found, presented the same microscopic appearances as the mud from the prisoner's boots: and the witness who gave this scientific evidence deposed that in his opinion the mud-spots were derived from this ditch. He had examined the mud of all the other ditches in the locality, and found it to be different. Admitting the opinion to have been correct, this circumstance clearly connected the prisoner with the act; and it was borne out by the fact that he had been seen near the spot on the night of the murder. In a case which occurred in Nov. 1857, I found granules of wheat-starch mixed with the blood-stains on the gaiters of a man charged with murder. He had been just before the occurrence engaged in sowing seed corn. So in *Reg.* v. *Steed* (Maidstone Summer Assizes, 1863), Dr. Pavy and I discovered on the soles of the boots belonging to the prisoner, portions of farinaceous matter adhering to the nails in addition to blood, hair, and woollen. (See page 429.) It was proved in evidence that after the murder the prisoner had gone into a country baker and flour-dealer's shop, and trodden on the floor on which there was flour. The chemical fact tended to corroborate the evidence that the prisoner was the man who had been seen in the shop.

Marks of Blood or other Substances on the Deceased.—All marks or stains of blood or dirt on a dead body require special observation. The impression of a hand, or of some of the fingers, may be found on the skin in a situation where it would have been improbable or impossible for the deceased to have produced it, even supposing that one or both of his hands were covered with blood. In one case of murder there was found the bloody impression of a left hand upon the back of the *left hand* of the deceased, in such a position that it was quite impossible the deceased himself could have made the mark! In all cases it should be noticed whether the *inside* or *outside* of the hand, or whether one or both hands are marked with blood, and the size and position of the marks should be described. Stains of blood on the dress of a wounded person or dead body may often furnish important circumstantial evidence. If there are several stabs or cuts on the body involving the dress, it should be observed whether the edges of one or more of them are stained with blood, as if from the wiping of a weapon, and whether the stain is on the outside or inside of the article of dress (p. 427). In simulated personal injuries, the stain of blood may be, through inadvertence, applied to the outside of the dress—a fact which might, in some instances, lead to the detection of the imposture. (See case by Dr. Bayard, 'Ann. d'Hyg. 1847, vol. 2, p. 219.) In judging from marks of blood in the *apartment*, we must take care that we are not unconsciously misled by the accidental diffusion of this liquid by persons going in and out. The following case, which occurred in France, will show the necessity of extreme caution. A young man was found dead in his bedchamber, with three wounds on the front of his neck. The physician who was first called to see the deceased had, unknowingly, stamped in the blood with which the floor was covered, and had then walked into an adjoining room, passing and repassing several times; he had thus left a number of bloody foot-prints on the floor. No notice was taken of this at the time; but on the following day, when the examination was resumed, the circumstance of the foot-prints was particularly attended to, and excited a suspicion that the young man had been murdered. The suspected person was arrested, and would have undergone a trial on the charge of murder, had not M. Marc been called in to examine all the particulars of the case. A similar circumstance occurred in the case of *Eliza Grimwood*, who was murdered at Lambeth in June, 1838.

Marks of Blood on the Assailant.—It is a very common idea that no person can commit a murder in which blood is effused without having his person and clothes more or less covered with blood. Nothing can be more erroneous. On several occasions I have been required to examine articles of clothing which had been worn by persons subsequently convicted of murder by wounding, and either no blood has been found on any part of the dress, or only small spots wholly out of proportion to the quantity of blood which must have flowed from the deceased. (*Reg.* v. *Harrington*, Chelmsford Assizes, 1852. *Reg.* v. *Fluck*, Ipswich Assizes, 1853. *Reg.* v. *Cass*, Carlisle Assizes, 1860. *Reg.* v. *Rowlands*, Beaumaris Assizes, 1861. *Reg.* v. *Edmonds*, Swansea Assizes, 1862.) In the case of *Gardner* (C. C. C. 1862), in which there had been a large effusion of blood from a severe wound in the throat, no blood-stains were found on the clothing of the man who was convicted of the murder. It is obvious that the throat of a person while standing, sitting, or kneeling, may be cut by a murderer from behind, and thus in appearance simulate suicide. Under these circumstances the clothes of the assassin would escape being stained with blood. The flowing or spurting of blood upon his clothes will depend upon his position in relation to the deceased at the time of inflicting the wound, and this must always be a matter of pure speculation. In entire violation of this simple principle, the fact of a prisoner's clothes not being marked with blood has been on more than one occasion urged as a proof of his innocence. (*Reg.* v. *Dalmas*, C.C.C., June 1844.) In this case the counsel for the prisoner wished to impress the jury, in what is commonly denominated a 'powerful' speech (in which medical facts and opinions are usually ignored), that no person could cut the throat of another without having his clothes covered with blood; and as there was not proved to be any blood on the clothes, the prisoner could not have been guilty of the crime. The facts were simply that the throat of the woman was cut while she was walking across Battersea bridge, the prisoner having inflicted the wound from behind! In *Reg.* v. *Müller* (C. C. C., October 1864), this fallacious species of defence was carried to a still greater length. Although the clothes of the prisoner were not produced, and the evidence showed that he had had time to change them, the counsel for the defence, in addressing the jury, said, 'Blood spurted out from Mr. Briggs (the deceased), and there is no doubt his assailant, whoever he was, must have been covered with blood, or have been considerably stained with it.' It should be observed, however, that the wounds inflicted were of a contused character, from which much blood was not likely to have flowed. The quantity of blood in the compartment of the carriage where the blows were struck, was small, the largest spot on a cushion being of the size of a sixpence. The clothes worn by the assailant need not, therefore, from this state of facts, have been 'covered with blood,' or 'considerably stained.' No artery was cut through, and there was no evidence of spurting. What blood was lost, was chiefly the result of splashing from the blows struck—some brain-substance having been found with the blood. Setting aside these erroneous assumptions, the evidence tended to show that had blood fallen upon his clothes, the prisoner had had ample time to dispose of them, and thus prevent a chemical examination of them. It is a new feature to have their non-production under such circumstances dealt with as a proof of innocence. There is no doubt that policemen are often misled in searching for criminals, by relying upon blood on clothing as a necessary accompaniment of an act of murder. This also leads them to magnify stains of red paint, iron rust, and fruit-stains on the dress of an accused person into marks of blood!

The presence of spots of blood on articles of clothing, knives, &c., taken from the persons of those who are accused of murder, may be quite consistent with innocence. Small spots or stains have often an undue importance attached to them. I have known minute spots of blood on the shirt of a man tried for murder by wounding, regarded as furnishing proof of criminality, until it was explained that they were probably derived from flea-bites, and that some were on one side and some on the other, showing that the shirt had been worn on the two sides. The coarse clothing worn by labourers may acquire blood-spots from a variety of accidental circumstances, which the accused may not always be able to explain. When he knows the stains are there and shows great anxiety to give some explanation of their presence, as that he had assisted in killing a pig, a rabbit, or that he was carrying game about him,—there may be some ground for suspicion. A medical practitioner should always make due allowance for the accidental presence of blood. In *Reg.* v. *Cass* (Carlisle Summer Assizes, 1860), among twelve different articles sent to me for examination for blood, was a sovereign, which it was supposed had been taken from a purse belonging to the deceased at the time of the murder and had been touched by a bloody hand. Although the reddish-coloured spot, which was in the letters near the rim, presented the appearance of dried blood, yet a chemical examination showed that it was not blood. A few days after, I examined a number of sovereigns received from a public bank. Some of these presented spots similar to that on the sovereign above mentioned, and one among them had a spot of dried blood upon it! A knife, coin, or purse, handled with a cut finger, might, if found in the possession of an accused person, be thus inadvertently set down as a proof of guilt.

CHAPTER 36.

CHEMICAL EXAMINATION OF BLOOD-STAINS—STAINS OF BLOOD ON LINEN AND OTHER STUFFS—AGE OR DATE OF THE STAINS—INSOLUBLE STAINS RESEMBLING BLOOD—STAINS OF FRUITS, FLOWERS, ROOTS, AND EXTRACTS—STAINS OF BLOOD ON WEAPONS—STAINS FROM IRON-RUST—ARTERIAL AND VENOUS BLOOD—VARIETIES OF BLOOD—BLOOD OF MAN AND ANIMALS—MICROSCOPICAL EVIDENCE.

Examination of Blood-stains.—It may appear at first sight an easy matter to say whether certain suspected spots or stains on articles of clothing, furniture, or weapons are or are not owing to blood; but, in practice, great difficulty is often experienced in answering the question. If the stains are large and recent, most persons may be competent to form an opinion; but the physical characters of blood are soon changed, even when the stuff is white and otherwise favourable for an examination. If the stains, whether recent or of old standing, are upon dark-dyed woollen stuffs, as blue, black, or brown cloth, or if they appear in the form of small or detached spots, or in thin films on dark clothing or rusty weapons, no one but a competent medical man should be allowed to give an opinion.

Chemical Analysis.—There is no direct chemical process by which blood can be identified, but we presumptively establish its nature by determining the presence and properties of the red colouring matter, or *hæmatine*. The chemical properties of the red colouring matter of blood are as follows:—1. It readily combines with cold *distilled water*, forming, if recent, a bright red solution. 2. The red colour of this solution is not changed to a crimson or a green tint by a few drops of a weak solution of *ammonia*. If the ammonia is concentrated, or added in large quantity, the red liquid will acquire a brownish tint. 2. The red liquid when *boiled* is coagulated—the colour is entirely destroyed, and a muddy brown flocculent precipitate is formed the quantity of which will depend on the quantity of colouring matter and albumen present. This coagulum, when collected on a filter and dried, forms a black resinous-looking substance, quite insoluble in water, but readily dissolved by boiling *caustic potash*, forming a solution which is of a greenish colour by reflected, and reddish by transmitted light. 5. To the above tests some have added the action of strong nitric acid, which coagulates the red colouring matter, turning it of a dirty brown hue. Such are the chemical properties of recent blood, whether derived from the human body or from that of any warm red-blooded animal.

Among chemical tests for *dried* or coagulated blood, it has been suggested that the suspected substance should be heated in a tube closed at one end, either alone or in mixture with the metal potassium. As the constituents of blood contain nitrogen, ammonia is a product in the first case, and cyanide of potassium in the second. The residue in the latter experiment is dissolved in water, and a solution of green sulphate of iron added, when Prussian blue is precipitated. These results, when obtained, simply indicate that the substance examined contained nitrogen. Cloth, flannel, silk, and leather contain nitrogen, and would yield similar products, although no blood was upon them. Such chemical processes are of little practical service, and it may be observed of them that when there is sufficient blood for the experiments, there are other and more satisfactory methods by which the fact may be proved.

Of the various red colouring matters extracted from vegetable and animal substances, there are none which, to the experienced eye, present the peculiar crimson red tint of blood, especially when the substance is examined in a good light by a low power of the microscope. When solutions of these red colouring matters are treated with ammonia, some, such as cochineal, logwood, and the colours of roots and woods, acquire a deep crimson tint, while others, such as the colouring matter of the rose and the red colours of flowers and fruits, are changed to a blue or green. The red colours are not destroyed by a boiling temperature, and even when mixed with albumen, this principle is coagulated, but the red colouring matter remains unchanged. In the case of blood, the effect of heat is to destroy the colour entirely.

When these vegetable colours are found upon linen and stuffs, they present under the microscope the appearance of a uniform stain or dye, unlike blood in colour. There is no coagulation, and the stained stuff is not stiffened as it is by dried blood.

Stains of Blood on Linen and other Stuffs. Their Age or Date.—Supposing the stuff to be white or nearly colourless, the spot of blood, if *recent*, is of a red colour; but it sooner or later becomes of a reddish-brown, or of a deep red-brown colour. The change of colour to a reddish brown I have found to take place in warm weather in less than twenty-four hours. After a period of five or six days, it is scarcely possible to determine, from the appearance, the date of a stain even conjecturally. In a large stain of blood on linen, no change took place during a period of five years:—it had a reddish-brown colour at the end of six weeks, which it retained for the long period mentioned. Indeed, it is extremely difficult in any case, after the lapse of a week, to give an opinion as to the actual date of a stain. Upon coloured stuffs, or dirty clothes, it is of course impossible to trace these physical changes in stains of blood,—on red-dyed stuffs the stain appears simply darker from the first, and in all cases the fibre of the stuff is more or less stiffened, as a result of the drying of the albumen associated with the red colouring matter. In examining an article of clothing, attention should be paid to the side of the stuff which has first received the stain: sometimes both sides are stained. The evidence derived from an observation of this kind may be occasionally of importance.

Dr. Pfaff, of Plauen, has performed numerous experiments on fresh and old blood-stains, with a view of determining their age or the date at which they were produced. (Casper's 'Vierteljahrschrift,' 1862, 1, 266.) He considers that the rapidity with which the red colouring matter dissolves in water and other liquids, may constitute a safe basis for a medical opinion. It has been long known that the fresher the blood, the more readily was the red colour imparted to water. It has also been pointed out that in fresh stains, the colour is crimson-red, while in old stains it is brown or red-brown. The novelty of Dr. Pfaff's suggestion consists simply in fixing the age of the stain on linen and other stuffs by the time required for the commencement and completion of the solution of the red colouring matter. The liquid employed by him as a solvent is a solution of arsenious acid in distilled water, in the proportion of one grain to two drachms. When a fresh stain was immersed in this liquid, or a portion of fresh and dry coagulum was moistened with it, the red colouring matter was removed in a few minutes. If the blood was from one to two days old, solution did not take place until after a quarter of an hour; if from three to eight days old, solution was effected in from one quarter to half an hour; if from two to four weeks, in from one to two hours; if from four to six months, in from three to four hours; and if a year old or more, it required from four to eight hours for perfect solution. In repeating some of these experiments on fresh and old blood, I have found that the arsenical liquid recommended by Dr. Pfaff is a valuable solvent for the red colouring matter; but I have obtained a solution of a coagulum of dried human blood five months old, in the course of a few minutes. In fact, from the rapidity of solution and the brightness of colour, this blood, according to the above result, might have been pronounced to be quite fresh. In operating on stains on linen and other stuffs, the rapidity of solution must obviously depend on so many contingencies irrespective of age, *e.g.* the quantity of the blood, the nature of the stuff, its thickness, and its permeability to liquid, that no definite rules can be safely laid down for determining the precise date.

The suspected stain should be first examined in a strong light, with a low power of the microscope. If caused by blood, it will not be a mere colouring of the fibres, but it will have a shining glossy appearance, and each fibre will be observed to be invested with a portion of dried coagulum or clot. In other cases, minute coagula or clots presenting the appearance of dried jelly will be seen in the meshes of the stained article of clothing. In certain lights the clots may appear of a dark red colour, but by changing the light, bright translucent portions of a peculiar crimson tint will come into view. The crimson stain of blood is unlike that of any other red colouring matter, and when the stained portion presents the character of a dry coagulum, the stain cannot be easily mistaken by a practised eye for that caused by other red colours. In fact, the microscope puts the observer of a small stain in the same position as a non-professional person, who unhesitatingly forms his judgment from a large quantity of dried blood. Portions of kino over a dress may present occasionally the appearance of coagulated blood; but kino differs in colour and in chemical properties from blood. The microscopical observation of a suspected stain on linen, cotton, or woollen, however small, is generally sufficient to enable an expert to form an opinion either in the affirmative or negative. The application of chemical tests may be resorted to for confirmatory evidence when there is any doubt in the mind of the observer.

If the stain is of sufficient size a slip of the dress, with the stain upon it, may be removed and suspended by a thread in a small test-tube containing a small quantity of distilled water. After a few minutes, or a few seconds, should the stain be recent, a red liquid will be seen falling to the bottom of the test-tube, giving, when the blood is recent, a red colour to the lower stratum of water, and when of old standing, a dark red-brown colour. Should the stuff be thick and coarse, or not readily pervious to water, the separation may not take place in less than an hour. When the stain is on thin silk or linen, I have found it to be speedily separated. Several slips of the stuff may be thus successively treated, until a liquid, sufficiently deep in colour for testing, is procured. If the quantity of coloured liquid thus obtained is small, the supernatant clear water may be carefully poured off, or drawn off by a pipette; but it will be found more convenient to use a small tube and a small quantity of water. The coloured liquid may then be tested by weak ammonia, and by the application of heat as described at p. 444. If ammonia produces any effect upon the solution of blood, it is simply to brighten it; this alkali never changes the red colour of blood to *green* or *crimson*. When the stain is of old standing, the solution in water is more slowly obtained, and does not present the bright red colour of blood. The action of ammonia may also be obscure, although it never gives to the liquid a green or crimson tint. The action of *heat* is in such cases certain and effectual: if the coloured solution is in such small quantity that there is no coagulum obtained by heat, it will be difficult to give a decided opinion, from the application of chemical tests that the stain is due to blood, and in these cases it will be absolutely necessary to employ the microscope for the detection of the red corpuscles or crystals of hæmatine. When the quantity of blood effused is moderately large, it may be easily detected by the above process, even after the lapse of a great length of time. I have thus detected the blood of the human body, and of the bullock, on cotton, linen and flannel, after a lapse of *three years*. If the stuff is dyed, we should proceed to examine the stains found upon it by a similar process. The dye is commonly fixed, and is not soluble in water. Thus, then, in testing for blood, we rely upon :—1. The ready solubility of the red colouring matter in water. 2. The negative action of ammonia. 3. The positive effect of heat in entirely coagulating and destroying the red colouring matter.

It may be objected, to this mode of testing, that red stains, closely resembling blood, are occasionally found on linen and other stuffs. All such stains are either entirely *insoluble* in cold water, or they are *soluble*; if insoluble, they cannot by any possibility be mistaken for blood. Should the linen or stuff which is stained with blood have been heated to a high temperature, the colouring matter may, as a result of coagulation, be rendered insoluble in water: but this is an exceptional condition. In the case of a body found wounded and burnt, it would be proper to allow for such a change, and the chemical evidence would fail. Should the blood-stain be mixed with oil or grease, this will interfere with the solvent action of water. Should it be on a plaster-wall or on wood, we must scrape or cut out a portion, and digest it in a small quantity of water in a tube or watch-glass. An unstained portion of the plaster or wood should also be examined.

There are certain red stains bearing a resemblance to blood, which are insoluble in water. These may be identified by their special characters. Among them are :—1. Certain *red dyes*, as madder, which, when fixed by a mordant, is not readily affected by ammonia. 2. *Iron-moulds.* These are of a reddish-brown colour, sometimes of a bright or orange red,—they are quite insoluble in water, but are easily dissolved by diluted hydrochloric acid, and on adding ferrocyanide of potassium to the hydrochloric solution, the presence of iron will be at once apparent. Care should be taken that the acid used for this purpose contains no iron. Iron-moulds are generally distinguished by their brown colour, and by the absence of all stiffening of the fibre, on the stained spot. Notwithstanding these well-marked distinctions, mistakes are sometimes made, as in the following case. Some years since, a man was found drowned in the Seine, at Paris, under suspicious circumstances. The body had evidently lain a long time in the water. On examining the shirt of the deceased, a number of red-brown stains were observed on the collar and body—resulting, as it was supposed, from spots of blood, which had become changed by time. On a chemical examination, however, they were found to be iron-moulds, produced by the rusting of a steel chain which the deceased had worn round his neck! 3. *Red paint.* Stains made with red paint containing peroxide of iron, have been mistaken for blood. They may be easily known by digesting them in diluted hydrochloric acid, and applying to the solution the tests for iron. Like those produced by iron-moulds, they are insoluble in water, and therefore cannot be confounded with blood-stains. The same may be said of spots of the ammonio-nitrate of silver changed by light, which I have known to be mistaken for old stains of blood. The stuff on which the spots of blood are found, may be itself stained with a red dye or colour, or it may be dyed with iron: in this case it will be necessary to test by the same process a piece of the coloured or stained portion, in order to furnish negative evidence that the suspected stains are due to blood. In *Spicer's* case (*ante*, p. 440), an apron which the prisoner wore was found with stains of blood upon it: but the greater part was covered with dark red stains, which turned out to be owing to a logwood-dye that the prisoner had used in his business. ('Med. Gaz.' vol. 37, p. 613.)

Among soluble stains resembling those of blood, are the spots produced by the juices of the *mulberry*, *currant*, *gooseberry*, and other *red fruits*. They are commonly recognized chemically, by dropping on them a weak solution of ammonia,—when the spot is turned either of a bluish, olive-green, or green colour. The red of cochineal is changed to a crimson on the addition of weak ammonia or potash. A spot of blood thus treated undergoes no change from the alkali. Acids turn them of a bright red colour. If a piece of the stained stuff is suspended in water, the coloured liquid, if any be obtained, is easily known from blood, by its acquiring a green or crimson tint on the addition of ammonia, and by the red colour not being *coagulated* or destroyed when the liquid is boiled. Independently of the fruits mentioned, there are vegetable juices that will produce stains of a red or red-brown colour, which might be mistaken for blood. In one instance, the red petals of the poppy gave rise to an error only removed by a proper examination. (Bayard, 'Man. Prat. de Méd. Lég.' 217.) In some red stuffs, the dye is often so bad, that water will dissolve out a portion of the colour; but in this case the action of ammonia and heat will serve readily to distinguish the stains from blood. The soluble red or brown stains given by woods or roots, such as *Logwood*, *Brazil-wood*, or *Madder-root*, are changed to a *crimson* colour by ammonia. They generally contain tannic acid, and acquire a dark olive-green colour when touched with a persalt of iron. It may be generally remarked of these stains, whether they are soluble or insoluble in water, that, although to the naked eye they may bear a slight resemblance to blood, they are wholly different when examined microscopically. The distinction of colour is well marked, and there is an absence of any appearance of coagulum. When thus examined, it is not probable that they can ever be mistaken for blood.

Removal of Blood-stains.—An attempt may have been made to wash out blood-stains, so that the colour may be more or less changed, and no chemical evidence obtained. There is a common notion that certain chemical agents will remove or destroy these stains; but this is not the case,—the colour may be altered, but when dried on the stuff it is not easily discharged or bleached. Chlorine, a most powerful decolorizing agent, turns the colouring matter of blood of a green-brown colour. Hypochlorous acid has a similar effect.

This acid has been recommended as useful by its bleaching properties for distinguishing the stain of blood from all other stains, excepting those produced by iron-rust. Orfila has, however, shown that it is not fitted for such a purpose, and that there are no better methods of testing than those above described. ('Ann. d'Hyg.' 1845, vol. 2, p. 112.) I have found that nothing removes a blood-stain, whether wet or dry, so effectually as simple maceration in *cold* water, although, when the stain is old, the process is sometimes slow. On an important trial for murder, at the Shrewsbury Lent Assizes, 1841 (*Reg.* v. *Misters*), this question as to the power of certain reagents in discharging stains of blood, was raised. Alum was traced to the possession of the prisoner; it was found dissolved in a vessel in his bed-room, and it was supposed that he had removed some blood-stains from his shirt by the use of this salt. Two medical witnesses deposed that they had made experiments, and had found that alum would take the stains of blood out of linen:—according to one, sooner than soap and water. The results of my experiments do not correspond with these. I have not found that alum removes stains of blood so readily as common water, and when alum is added to a solution of hæmatine in water, so far from the colour being discharged, it is slowly converted to a deep greenish-brown liquid. In one experiment, a slip of linen, having upon it a stain of dried blood of old standing, was left in a solution of alum for twenty-four hours; but not a particle of the red colouring matter had been extracted, although it was changed in colour. The prisoner's guilt did not rest on this point alone,—that was made sufficiently evident from other circumstances: but there have been few cases tried in England where the facts connected with the analysis of blood-stains were so closely examined, or of such great importance, as in this. In a case to be presently related, I was consulted on the question whether the alkali contained in yellow soap would alter or remove blood-stains. The effect of this substance, as well as of potash, soda and their carbonates, is to change the red colour of blood to a deep greenish-brown, like many other reagents, but they do not exert on it any discharging or bleaching power. Combined with friction, blood-stains may of course be easily effaced by any *cold* alkaline or soapy liquid.

Detection of Blood on Weapons.—When recent, and on a polished instrument, stains of blood are easily recognized; but when of old standing, or on a rusty piece of metal, it is a matter of some difficulty to distinguish them from the stains produced by rust or other causes. If the stain is large, a portion may be easily scraped off on drying. This may be placed in a watch-glass with some distilled water,—the solution filtered to separate any oxide of iron, and then tested. If the water by simple maceration does not acquire a red or red-brown colour, the stain is *not* due to blood. If it acquires a red colour, the solution may be tested by the methods above described. Sometimes the stain appears on a dagger or knife either in the form of a thin yellowish or reddish film, or in streaks, and is so superficial that it cannot be mechanically detached. We should then pour a thin stratum of water on a piece of plate-glass, and lay the stained part of the weapon upon the surface. The water slowly dissolves the colouring matter of blood, and the coloured liquid may be examined by the chemical processes above recommended. If the weapon has been exposed to heat, this mode of testing may fail.

There is often a remarkable resemblance to the stains of blood on metal, produced by the *oxide or certain vegetable salts of iron.* If the juice or pulp of lemon or orange is spread upon a steel blade, and is exposed to the air for a few days, the resemblance to blood produced by the formation of *citrate of iron* is occasionally so strong that I have known well-informed surgeons to be completely deceived: they have pronounced the spurious stain to be blood, while the real blood-stain on a similar weapon was pronounced to be artificial. The difficulty of distinguishing such stains by the eye, is well illustrated by the following case, which occurred in Paris. A man was accused of having murdered his uncle, to whose property he was heir. A knife was found in his possession, having upon it dark-coloured stains, pronounced by those who saw them to be stains of blood. M. Barruel and another medical jurist, were required to determine the nature of the stains, and the examination was made before a magistrate in the presence of the accused. They were clearly proved, by these and other experiments, to be spots produced by the citrate of iron. It appeared on inquiry, that the knife had been used by some person a short time previously, for the purpose of cutting a lemon; and not having been wiped before it was put aside, a simple chemical action had gone on between the acid and the metal which had given rise to the appearance. This case certainly shows that physical characters alone cannot be trusted in examination of these suspected stains. Stains of the *citrate of iron* may be thus distinguished:—The substance is soluble in water, forming, when filtered, a yellowish-brown solution, totally different from the red colour of blood under the same circumstances. The solution undergoes no change of colour on the addition of ammonia. It is unchanged in colour, but may be partially coagulated at a boiling temperature, and it is at once identified as a salt of iron by giving a blue colour with the ferrocyanide of potassium. I have observed, that spots of the citrate of iron on knives (for they are not found on other weapons) are often soft and deliquescent, while those of blood are commonly dry and brittle.

It is not always easy to distinguish by sight a stain of blood on a weapon from a mark produced by *iron-rust.* When suspicion exists, marks are pronounced to be due to blood, which, under other circumstances, would have passed unnoticed. One source of difficulty is this: the iron-rust on an old knife is often mixed with some article of food or even with blood itself. We must here pursue the same mode of examination as if the stain were of blood; we macerate the weapon, or a portion of the coloured deposit scraped from the surface, in a small quantity of distilled water, and filter the liquid. If the stain is due to iron-rust alone, this will be separated by filtration, and the liquid will pass through colourless. The absence of blood is thereby demonstrated: for I need not here consider the objection that the weapon may have been exposed to heat, and the blood-stains have been thereby rendered insoluble in water. If we now digest the brown undissolved residue left on the filter, in hydrochloric acid free from iron, we shall obtain a yellowish solution, which will give with the ferrocyanide of potassium a blue colour—Prussian blue. The diluted acid may be placed at once on the suspected stain when it is too superficial to admit of removal by a knife. If caused by rust, it will be entirely removed, and the acid will not be perceptibly coloured; if caused by blood, it will not be readily removed, and the liquid will have a red colour. In testing the acid liquid, the presence of iron may be detected in either case, since the diluted acid will dissolve a portion of the metal, even although the blade of the weapon may not be rusty. In all old blood-stains on rusty weapons, blood and oxide of iron are intermixed. The blood may be separated by digesting the compound in distilled water in a small tube, and decanting the solution from any sediment. The colouring matter is dissolved by the water, while the rust is left as a sediment. Dilute acetic acid will dissolve the blood, and leave the rust.

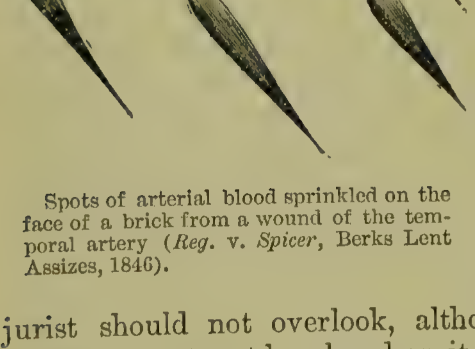
The following case was referred to me for examination a few years since. A man was suspected of murder, and there were on his shirt some stains, which were supposed to have been produced by blood. Around the collar and upper part of the shirt, there was a large and somewhat deep pinkish-red stain, in some respects resembling washed blood. This appeared to be an unusual situation for blood to be found sprinkled: and upon trying the stained linen by the processes above mentioned, the colour entirely resisted separation by water, and was turned of a slight crimson tint by ammonia. The stain was thus proved not to be due to blood. On inquiry, it was ascertained that the man had worn round his neck a common red handkerchief during a wet night, and while taking violent exercise! The reddish-coloured stain was thus accounted for. There were, however, some other marks on the shirt which required examination, as there was a very strong suspicion against this man. These were on the sleeves, at those parts which would be likely to receive stains of blood if they had been rolled or turned up at the wrists; and it was clearly ascertained that the murderer, in this case had used a quantity of yellow soap in washing his hands. The stains were of a brownish colour, without any shade of red; they were faint in parts, and diffused, conveying the impression that an attempt had been made to wash them out. So far as external characters were concerned, it was difficult to say whether they had been produced by blood or not. On examining the parts of the shirt corresponding to the armpits, stains precisely similar were there seen, evidently resulting from cutaneous perspiration, since the suspicion of blood being effused on these parts of the shirt, under the circumstances, could not be entertained. Slips of linen from the stained portions of the sleeves were digested in water. In twenty-four hours the stains were entirely removed, and the lower stratum of water in each tube had acquired a straw-yellow colour. There was not the least shade of a red or brown colour; the solution was wholly unlike that produced by blood under any circumstances. The solution was unaffected by ammonia, as well as by a heat of 212°; but it acquired a faint opalescence on the addition of nitric acid. These results not only indicated the absence of blood, but showed that the stains were due to cutaneous perspiration issuing from a dirty skin through a dirty dress. The stains on the parts corresponding to the armpits could not be ascribed to blood, and from the similarity in physical and chemical properties, it was impossible to attribute those on the sleeves to any sanguineous effusion. It happened, however, that a large pocket-knife, with numerous dark red stains on the blade and between the layers of the handle, was found upon this man; and this was also sent for examination. Several persons who saw the knife pronounced a strong opinion that the marks were due to blood. The stains were composed of some soft viscid matter, which gave out ammonia when heated, and left a residue of peroxide of iron. On digesting the matter in water no portion was dissolved; and it was, therefore, evident that they were due not to blood, but to a mixture of some animal matter, probably food, with iron-rust. These results were somewhat in the man's favour—at least, they removed what was considered to be a strong circumstantial proof of his guilt. He was subsequently tried for the murder, and acquitted on an alibi, established by the evidence for the prosecution.

In the case of Mr. Briggs ('*Reg.* v. *Müller*,' Central Crim. Court, October 1864), a question arose whether there was dried coagulated blood upon a life-preserver, which the prisoner might have employed. The weapon consisted of a heavy mass of lead, enclosed in a network of string, and secured to a whalebone handle. There was a substance on the network resembling dried blood. When this was removed and placed in contact with water, it was not dissolved, and, under the microscope, presented the appearance of brown flakes, which gave no colour to the surrounding liquid. On applying a red-hot platinum wire to the supposed coagulum it melted, and gave off the smell of resin. It was part of a resinous composition which had been used for securing the lead to the network; it had become softened by heat, and had oozed out between the meshes. No blood could be detected in any part.

From the foregoing remarks, we may justly infer that the chemical analysis of suspected spots or stains on weapons and clothing, is by no means an unimportant duty. If we cannot always obtain from these experiments affirmative evidence, they often furnish good negative proof, and thus tend to remove unjust suspicions against accused parties. There is one circumstance, however, of which a medical jurist is entitled to complain, namely, that evidence should be received on matters of this kind from non-professional persons, or that any confidence should be placed in an opinion derived from physical characters only. On the occasion of the murder of *Eliza Grimwood*, in June 1838, committed, as it was, under circumstances of the greatest mystery, and the perpetrator of which has not yet been discovered, the examination of suspected marks resembling blood, became rather an important part of the inquiry, but it was most improperly conducted. The finger-plates of the door of the room, in which the murder was perpetrated, presented some dark stains, supposed to have been produced by the bloody hand of the murderer in the act of escaping. The only test to which these were submitted was, that the magistrate, before whom the case was heard, tried to rub off some of the stains with a piece of blotting-paper, but did not succeed; and he expressed his opinion, that, if they were blood-stains, they had been wiped! It is easy to perceive to what results superficial examinations of this kind may lead.

Detection of Fibrin.—In the process for examining blood-stains, it has not been thought necessary to refer to the properties of fibrin. Fibrin forms about 1-500th part of human blood; it exists in the blood of all warm-blooded animals. The other animal liquids in which it is found are the chyle and lymph. It is the chief constituent of muscular fibre. When the blood is in sufficient quantity, a pale film of fibrin may be left upon the stained substance, after the colouring matter has been removed by digestion in water. Small quantities of fibrin are not easily identified by its chemical properties. Animal fibrin so closely resembles coagulated albumen and gluten, that it cannot be distinguished from them by chemical tests. Hence, unless evidence of the presence of red colouring matter be obtained, the presence of fibrin cannot be relied on; and if this evidence is obtained, the demonstration of its properties is unnecessary, for there is no red colouring matter which, under due precautions, can be mistaken for that of blood. Evidence on this subject was tendered in the case of *Reg.* v. *Reed* (York Winter Assizes, 1847), but it was not well received by the Court. It has been supposed that the demonstration of the presence of fibrin in a blood-stain would enable us to say whether the blood had been effused from a living or dead body; but, admitting that the existence of fibrin in a small quantity of dried blood upon an article of dress could be indisputably established, this fact would not enable us to give a conclusive answer to the important question above suggested. If the quantity of blood examined be comparatively great, and no fibrin can be procured from it after complete digestion in cold water, it is probable that this blood has not come from a living body, and that it is merely a mixture of red colouring matter and serum, like that found in the vessels of the dead body after perfect coagulation. But the experimentalist must bear in mind that small stains of blood will commonly leave no perceptible traces of fibrin. On the other hand, if fibrin were clearly obtained, it would be by no means proved that the blood yielding it had issued from a *living* body. Until the blood has coagulated, it retains fibrin; and coagulation seldom commences in the dead body until after the lapse of three or four hours, although, if removed from the body, it speedily becomes solid.

Arterial and Venous Blood.—It is not possible to distinguish *arterial* from *venous* blood by any physical or chemical characters, when it has been for some days effused, and is in a dry state upon articles of dress or furniture; but this, in medico-legal practice, is not often a subject of much importance, since there are few cases of severe wounds, either in the throat or other parts of the body, in which the two kinds of blood do not escape simultaneously. The most striking and apparent difference between them, when recently effused, is the *colour*; the arterial being of a bright scarlet, while the venous is of a dark red hue; but it is well known that the latter, when exposed to air for a short time, acquires a florid red or arterial colour; and the kinds of blood, when dried, cannot be distinguished chemically by any known criterion. If the coat, or other stuff, stained with blood, were of a dark colour, the liquid would be absorbed, and speedily lose its physical characters. Arterial blood contains more fibrin than venous, and coagulates more firmly. The microscope shows no appreciable difference in the blood-corpuscles, and chemistry does not enable us to apply any test so as to make a satisfactory distinction between them. In this deficiency of microscopical and chemical evidence, an attempt has been made to establish a distinction by noticing the physical appearances of the blood-stains. Thus, it is alleged, the arterial blood will be indicated by its being *sprinkled* over surfaces upon which it has fallen, while the venous blood is always poured out in a full stream. In most wounds which prove fatal by hæmorrhage, the blood is poured out simultaneously from arteries and veins. The sprinkled appearance of the blood, when it exists, will, cæteris paribus, create a strong presumption that it was poured out from a *living* body—for after the heart has ceased to act, the arteries lose the power of throwing out the blood in jets. This mode of distinguishing arterial from venous blood was adduced as evidence in the case of *Sellis*, who destroyed himself after having attempted to assassinate the Duke of Cumberland. There was the appearance of sprinkled blood on the coat-sleeve of Sellis, and it is stated that the temporal artery of the Duke had been wounded. Sir Everard Home thence inferred that Sellis had attacked the Duke, and wounded the artery, which had led to the sprinkling of the sleeve. ('Will's Circ. Ev.' 98.) This method of distinguishing the two kinds of blood, therefore, may be occasionally available for practical purposes; but it must be remembered that accident may lead to the sprinkling of blood from a small vein which has been wounded, while blood may be poured out in considerable quantity from an artery, especially if large; and if it fall on one spot at a short distance, it may produce a soaked appearance. The sprinkling may be expected only when the wounded artery is small, and the blood is effused at a distance. This is a fact which a medical jurist should not overlook, although, for the reasons stated, too great a reliance must not be placed on it. The spots of blood, if thrown out from a living blood-vessel, speedily consolidate, and the fibrin, with the greater portion of the colouring matter, is found of a deep red colour at the lower part of the spot, the upper portion being of a pale red. The lower and thicker part has commonly a shining lustre, as if gummed, when the spot is recent, and when it has been effused upon a non-absorbent surface. This glazed appearance is, probably, given by the evaporation of the aqueous, and the rapid desiccation of the albuminous portions. In *Reg.* v. *Spicer* (page


Spots of arterial blood sprinkled on the face of a brick from a wound of the temporal artery (*Reg.* v. *Spicer*, Berks Lent Assizes, 1846).

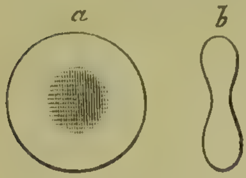
439), there was a wound of the temporal artery of the deceased woman. A brick in the wall, opposite to the spot where the wound was inflicted, presented the appearance shown in the annexed illustration. The size and direction of the spots vary according to the distance of the person wounded, and the direction in which the spurting has taken place against the surface.

When blood falls upon porous articles of clothing, as linen or cotton, it is absorbed, and produces a dull stain. In dark-coloured articles of dress, it is sometimes difficult by daylight to perceive these stains. The part appears stiffened, and has a dull red-brown colour, which is sometimes more perceptible when seen by the reflection of the light of a candle.

In trusting to the coagulation of the sprinkled blood as evidence of its escape from a living vessel, it must be remembered, that three hours may elapse before it coagulates in the healthy body after death. Hence, blood which has escaped from a recently dead body, although it would not be found diffused as if by spurting, might, in so far as coagulation is concerned, assume the appearance of having been effused from a living body. On this fact Donné has founded a process for determining whether a person is really dead. ('Cours de Microscopie,' 54; see also *ante*, p. 21.) The mere fact of the blood in blood-stains being found coagulated, does not prove that the person was actually living when the blood was effused. It merely shows that he was either living or but recently dead. Some states of the living body appear to favour and others to prevent the coagulation of the blood after death. Lehmann asserts that, in the bodies of persons who have recently died from violent inflammations excepting those which affect the brain and spinal cords, blood, after death, has a thick fluid character, a reddish-brown colour, and it readily coagulates. It becomes bright red on exposure to air. In pyæmia and some fevers, the blood is thinly fluid, uncoagulable and of a dirty brownish colour. ('Physiological Chemistry,' vol. 2, p. 206.)

In spite of the great advances made in the construction and use of the microscope, there is no method known by which the blood of a man can be distinguished from that of a woman, or the blood of a child from that of an adult. The blood of a child at birth contains less fibrin, and forms a thinner and softer coagulum than that of the adult. A medico-legal question has arisen, on more than one occasion, whether there were any means of distinguishing *menstrual* blood from that of the body generally. This liquid contains fibrin, although the proportion is much less than in venous or arterial blood, red colouring matter, and the other constituents of blood. The only differences noticed are of an accidental kind: 1st, that it is acid, owing to its admixture with vaginal mucus; and 2nd, that, under the microscrope, it is mixed with epithelial scales, which it has derived from the mucous membrane in its passage through the vagina. (Donné, 'Cours de Microscopie,' p. 139.) A case occurred in France, which induced the Minister of Justice to refer the consideration of this question to the Academy of Medicine. The reporters, MM. Adelon, Moreau, and Le Canu, came to the conclusion that there were no means of distinguishing menstrual blood dried on clothing from that which might be met with in a case of infanticide or abortion. ('Ann. d'Hyg.' 1846, vol. 1, p. 181.)

Microscopical Evidence. Blood-corpuscles.—Hitherto the microscope has been referred to as an aid to the examiner in drawing a distinction between the appearances presented by blood-stains in the dry state, and those caused by other substances. Its use, however, extends much beyond this. The spots or stains may be so small as not to admit of removal, for the purpose of applying chemical tests. If an examination of the dry stain with a low power (20 or 30 diameters) justifies further proceedings, we may then employ the microscope for the purpose of detecting those peculiar bodies on which the colour of red blood is known to depend. The red colouring matter of blood consists of minute coloured cells or corpuscles, floating in a clear liquid (serum). The annexed engraving shows the form which it presents in the class mammalia. *a* represents the circular form, when seen in front, the shaded portion being a depression which under a certain disposition of the light assumes the appearance of a solid and opaque nucleus; *b* represents a corpuscle seen edgewise, in which case it presents somewhat the shape of a biconcave lens. It owes this form to the central depression on each face. Other red colouring matters, such as madder, cochineal, or lac, do not owe their colour to independent cells or corpuscles. Hence, if corpuscles, of the form and size of those found in mammalian blood, are visible under the microscope, there can be no doubt that the liquid is blood. Such evidence can, however, be safely received only from one who has been accustomed to the use of this instrument, and to the examination of blood. In order to examine the suspected substance for corpuscles, the best plan of proceeding, when the particles of coagulum are very small, is to breathe several times on a glass slide, then place the small fragments of coagulum on the slide, and again breathe over them. A slip of thin glass may then be laid upon them. If they consist of blood a red margin will soon appear, and in the fluid portion, by the aid of a magnifying power of from 300 to 500 diameters, some of the corpuscles of the blood may be recognized. They are seldom so perfectly spherical as in the fresh state, and they appear small, and frequently shrunk or corrugated. In some cases, only fragments of the envelopes can be seen. This method has been suggested by Dr. Erpenbeck. (Casper's 'Vierteljahrschrift,' 1862, vol. 21, p. 259.) The condensed moisture of the breath serves the purpose of water, in breaking up the small portions of dried blood, without destroying the corpuscles by too much dilution. The red colour of the blood is well brought out under these circumstances. In thus treating cochineal, extract of logwood, kino, and other colouring matters, the appearances observed were wholly different.



Blood corpuscle highly magnified.

If the suspected clot is in larger quantity, it may be removed from the stuff and placed to macerate in one or two drops of water on a glass slide. It should be covered with thin glass, in order to prevent rapid evaporation. This method of extracting the corpuscles has frequently failed, owing to the quantity of water employed having been too large. Under these circumstances, the corpuscles are distended and rapidly destroyed, while the water simply becomes coloured. It is by no means easy in all cases to obtain from dry coagula clear and distinct evidence of the presence of these corpuscles, especially when the blood is old. In drying, the blood-cells lose their form, and they do not readily resume it when again moistened. Unless they are seen after a short maceration in a very small quantity of water, it is probable they will not be seen at all. To accelerate their separation various chemical liquids have been employed. Thus strong solutions of sulphate of soda and common salt, as well as liquid albumen and serum, have been employed as fluid media for breaking up the dried clots of blood. There are disadvantages attending the use of these; and after many experiments, I have found that a mixture of glycerine and water may be employed in place of pure water. The proportions which are most convenient are, one part by measure of glycerine, to three parts by measure of distilled water. A solution of arsenious acid, in the proportion of four grains to an ounce of distilled water, as recommended by Dr. Kunze, is also a rapid solvent of the coagula. When this is used, the examination should take place as soon as the liquid begins to be coloured at the margin, or the corpuscles may be destroyed, and only fragments of their envelopes seen. MM. Lesueur and Robin have adopted the following plan, which they affirm to be successful for the detection of mammalian blood. A portion of the suspected coagulum is scraped off the stained substance into a solution of sulphate of soda, made slightly alkaline by the addition of a little caustic soda, and it is then examined under the microscope, with a power of 520 diameters. At first, the substance appears entirely homogeneous, but in half an hour it swells, and in another half hour globules are formed, which can be separated by gently rubbing the glass slides one upon the other. These observers identified the globules as those of mammalian blood, *i. e.* of animals which suckle their young. ('Chemical News,' 1850, vol. 2, p. 295.)

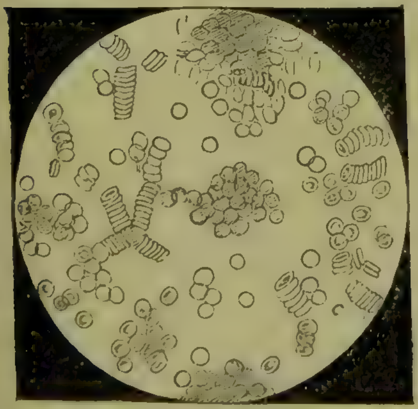
In reference to stains on clothing, if they present any appearance of dry coagula, these should be carefully scraped off, and treated in the manner above described. If no portions of solid coagula can be procured, there will be but little hope of obtaining evidence of the presence of corpuscles in the suspected stain. The stained portion may be cut out and macerated in a small quantity of water. Under these circumstances, the corpuscles may be sometimes seen aggregated, or in groups, in the fibres of the stuff, as in the subjoined engraving, in which the stain of blood was on a shirt. (Briand's 'Manuel de Méd. Lég.' p. 747, 1863.)

a, Corpuscles of blood in linen fibre; *b*, a group detached.

The subjoined illustrations show the appearances presented by blood-corpuscles, when examined by a power of about 300 diameters, and under different methods of treatment. The first illustration (Fig. 1) is from an engraving in Lehmann's 'Physiological Chemistry.' It represents the appearance of a drop of healthy human blood. The red blood-cells are partly detached, partly united in rolls, and partly in irregular clusters. In the vacant spaces between them there are delicate threads of fibrin. The outlines of the blood-cells are rendered, in some instances, indistinct, by reason of this web of fibrin above them.

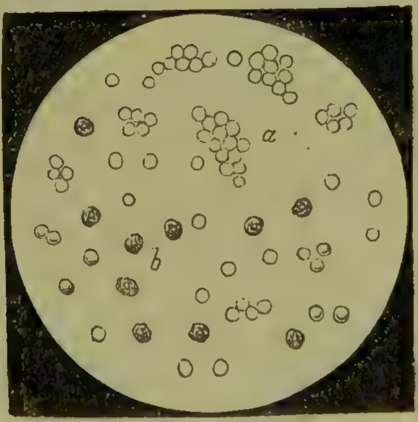
In Fig. 2 the corpuscles are seen free from fibrin. Only a small portion of those which were in the field have been engraved. The corpuscles are seen detached and in groups. The shaded bodies are the white corpuscles of the blood. They are not so well defined in form, and present an irregularity of surface, by which they may be distinguished from the coloured blood-cells.

FIG. 1.



Human blood-corpuscles with fibrin.

FIG. 2.



Human blood-corpuscles from a dried specimen magnified 319 diameters.

Fig. 3 represents the appearance of the corpuscles as they are seen in water, and Fig. 4 their appearance when examined after treatment with a concentrated solution of sulphate of soda. The effect of water is to alter the shape and render them spherical or globular. Water also renders them paler, and finally destroys them. In Fig. 4, those corpuscles which are seen edgewise have a lenticular shape. The shaded centre is the depression elsewhere described (p. 454) and figured on a larger scale. These are taken from engravings in 'Lehmann's Physiological Chemistry.'

FIG. 3.

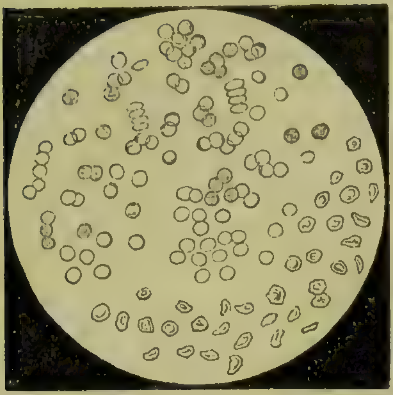
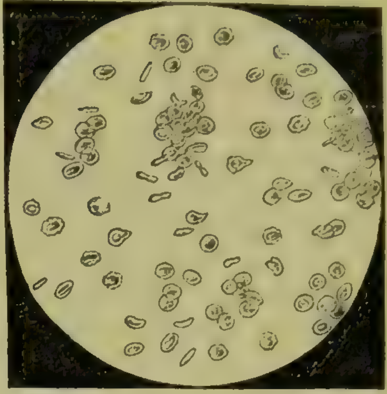


FIG. 4.



Blood of Man and Animals.—When marks of blood have been detected on the dress of an accused person, it is by no means unusual to find these marks accounted for by his having been engaged in killing a pig, bullock, or sheep, or in handling fish or dead game. Of course every allowance must be made for a statement like this, which can be proved or disproved only by circumstances; but the question here arises, whether we possess any *certain* means of distinguishing the blood of a human being from that of an animal. Some years since, M. Barruel and other French medical jurists, affirmed that by mixing fresh blood with one-third or one-half of its bulk of strong sulphuric acid, and agitating the mixture with a glass rod, a *peculiar odour* was evolved, which differed in the blood of man and animals, and also in the blood of the sexes. This odour, it was said, resembled that of the cutaneous exhalation of the animal, the blood of which was made the subject of experiment. They hereby pretended to determine, whether any given specimen of blood belonged to a man, a woman, a horse, sheep, or fish. Others, endowed, probably, with a more acute sense of smelling, asserted that they had succeeded, by this process, in identifying the blood of frogs and fleas! (See Devergie, 'Méd. Lég.' vol. 2, p. 907.) It is true, that strong sulphuric acid does give rise to a particular odour when mixed with fresh blood, probably owing to its decomposing action on some of the animal principles; and it is possible that some persons may discover a difference in the odour, if not according to the sex, at least according to the animal. But, assuming this to be true, there is probably not one individual among a thousand, whose sense of smelling would allow him to state, with undeniable certainty, from what animal the unknown blood had really been taken. Any evidence short of this would not be received by an English Court of Law; for it is considered better, in this country, not to decide at all, than to decide on principles which are exposed to unavoidable fallacy. Besides, it must be remembered that, in general, the operator has not before him the fresh blood, or blood in large quantity, but merely a diluted solution of the dried colouring matter, mixed with a small quantity of serum, and sometimes only a few small spots, yielding no perceptible quantity of solution. In a case of some importance, which occurred in Paris, the testing of blood by odour completely failed in the hands of M. Barruel and two other eminent French medical jurists, MM. Tardieu and Chevalier. The mistakes made by these experts are admitted by themselves to have been of so serious a nature as to render this mode of obtaining evidence in any future case inadmissible. ('Annales d'Hyg.' 1853, t. 1, p. 413.) For additional remarks on this subject, see paper in 'Guy's Hospital Reports,' Oct. 1851.

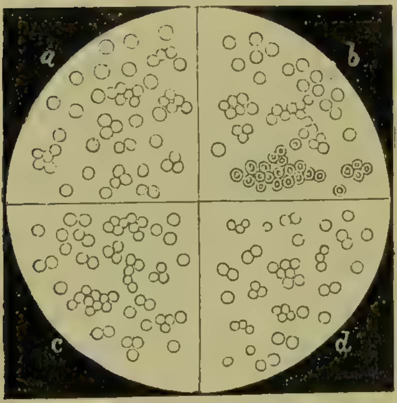
In a few cases, the situation of the stains on different and remote parts of the dress, back and front, as well as in concealed or covered parts, may show that the defence is inconsistent with the facts; but, in the large majority, a medical witness will be required to state whether the blood is or is not human. It has been already observed that there are no chemical differences between the blood of man and animals. The red colouring matter, the albumen and fibrin, are the same, and chemical tests produce on them precisely similar results. The microscopical differences refer to the *shape* and *size* of the corpuscles. 1. With respect to *shape*. In all animals with red blood, the globules have a disc-like or flattened form. (See Figs. p. 454, *ante.*) In the mammalia, excepting the camel tribe, the outline of the disc is *circular*. In this tribe, and in birds, fishes, and reptiles, the corpuscles have the form of a lengthened ellipse or *oval*. In the three last-mentioned classes of animals they have a central nucleus, which gives to them an apparent prominence in the centre. The blood-corpuscles of all the mammalia, including those of the camel-tribe, have no central nucleus, and they appear depressed in the centre. (p. 454.)

The microscope, therefore, enables an observer to distinguish the blood of birds, fishes, and reptiles, from that of a human being; and this may be of great importance as evidence. In *Reg.* v. *Drory* (Essex Lent Assizes, 1851), it was suggested in the defence, that the blood-stains on the clothes of the prisoner had been caused by his having killed some chickens. The shape of the corpuscles negatived this part of the defence. In another case, the blood was alleged to be that of a fish; this was also disproved by the shape. Dr. Bennett states that on one occasion he was called to see a patient (labouring under bronchitis) who was spitting florid blood. On examining the sputum with a microscope, he found that the coloured blood-corpuscles were those of a bird. On his telling the patient that she had mixed a bird's blood with the expectoration, she was astounded, and confessed that she had done so for the purpose of imposition. ('The Microscope as a Means of Diagnosis,' p. 185.)

The chief microscopical distinction between the *blood of man and domestic animals*, consists in a minute difference in the *size* of the corpuscles. This, however, is only an average difference; for the corpuscles are found of different sizes in the blood of the same animal. In making use of this criterion, it would be necessary to rely upon the size of the majority of the corpuscles seen in a given area, and under the same power of the microscope. It is a curious fact that their size bears no relation to the size of the animal. Thus, in the horse, ox, ass, cat, mouse, pig, and bat, they are, on an average, nearly of the same size; the difference is so slight as to be practically inappreciable. In these animals they are smaller than in man, and in several of the mammalia. The corpuscles in man, the dog, the rabbit, and the hare, are of nearly the same size. In the blood of the sheep and goat, they are smaller than in other mammalia. The size of the corpuscle bears no proportion to the age of the animal: thus in the blood of the human fœtus they are to be found as large as in that of the adult.

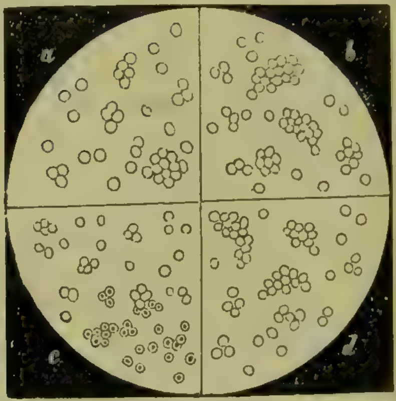
The measured diameter of the corpuscles in *human blood* varies, according to Gulliver, from 1-2000th to 1-4000th of an inch, the average size in both sexes being 1-3200th of an inch. From an examination of numerous specimens of fresh human blood, I have found the average diameter of the globules to be the 1-3500th part of an inch, the maximum size being 1-3000th, and the minimum 1-5000th of an inch. The corpuscles of human blood are larger than those of domestic animals. The subjoined measurements, in fractions of an inch, are those given by Mr. Gulliver, excepting the figures in brackets, which are from my own micrometrical observations. The average diameter is, in the dog, 1-3540th (max. 1-4000th, min. 1-6000th),—in the hare, 1-3607th (1-4000th; max. 1-2000th, min. 1-8000th),—in the mouse, 1-3814th,—in the ass, 1-4000th—(rabbit, 1-4000th),—in the pig, 1-4230th (1-4250th)—in the ox, 1-4267th,—(in the cow, 1-4000th to 1-4200),—in the cat, 1-4400th,—in the horse, 1-4600 (1-5000th), in the sheep, 1-5300th (1-5333rd to 1-6000th),—in the goat, 1-6366th. These measurements apply to *recent* blood, which has not been allowed to become dry on animal and vegetable stuffs. In this case a distinction might be made between the blood of a human being and a sheep or goat. With respect to the dog, hare, and rabbit it would be, even under these favourable circumstances, a matter of some difficulty. When blood is dried on clothing, and it is necessary to extract the corpuscles by means of a liquid of a different nature from the serum, we cannot rely on slight fractional differences, since we cannot be sure that the corpuscles, after having been once dried, will ever reacquire in a foreign liquid the exact size which they had in serum. Medical evidence must therefore be based, in such cases, on mere speculation. (See 'Guy's Hospital Reports,' vol. 7, pt. 2, 1851.)

Fig. 5.



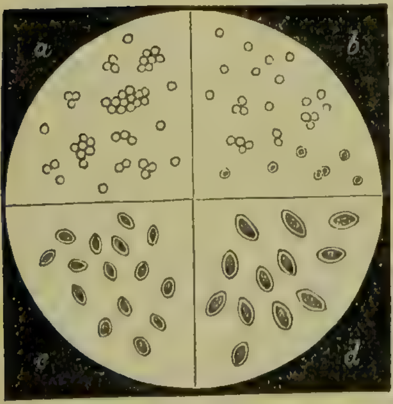
Blood-corpuscles magnified 319 diameters.
a. Of the dog.
b. Of the mouse.
c. Of the rabbit.
d. Of the ass.

Fig. 6.



Blood-corpuscles magnified 319 diameters.
a. Of the cow.
b. Of the pig.
c. Of the ox.
d. Of the cat.

Fig. 7.



Blood-corpuscles magnified 319 diameters.
a. Of the horse.
b. Of the sheep.
c. Of the common fowl.
d. Of the salamander.

The subjoined illustrations represent, in the dry state, the blood-corpuscles of twelve animals—ten taken from the mammalia or warm-blooded suckling animals—one from a bird, and one from a reptile. All are represented under the same magnifying power in quadrants of circles so as to allow of a comparison.

On comparing the ten samples of mammalian blood in these illustrations, with that representing human blood (in Fig. 2, p. 455) prepared under precisely similar circumstances, and magnified in the same degree, it will be perceived that the only difference consists in the human corpuscles being somewhat larger. The difference in size, however, from the corpuscles of the dog and the rabbit is so small as to be scarcely appreciable. The corpuscles of the bird and the reptile are well characterized by their size, their oval shape, and the presence of a nucleus in the centre of each. The length of the corpuscle of the fowl's blood, was found by measurement to be the 1-2250th part of an inch, and its width the 1-4500th of an inch. The length of the corpuscles in the salamander was the 1-750th of an inch, and the width the 1-1125th of an inch.

In reference to this scientific question, it must be regarded as still unsolved. There are no certain methods of distinguishing microscopically or chemically the blood of a human being from that of an animal, when it has been once dried on an article of clothing.

The extent to which a medical witness is justified in going on trials for murder, on which this important question arises, appears to me to be this: the size and shape of the corpuscles are or are not consistent with their being the corpuscles of human blood; but it is impossible, in the present state of science, to affirm that the corpuscles, extracted from stains dried on clothing or weapons, are not those of some domestic animal, belonging to the class mammalia. This was the substance of the evidence which I gave in the case of *Reg.* v. *Munro* (Cumberland Lent Assizes, 1855), a case in which everything turned on circumstantial evidence of a medical and moral kind. I declined to say absolutely that the stains were caused by human blood, although the corpuscles coincided in measurement with them. In one instance, a medical witness professed to make a distinction between certain spots on a man's clothes—assigning some to the blood of a horse, and others to human blood; and, on another occasion, scientific evidence was so strained by a witness upon this question as to elicit a sharp rebuke from the learned judge who tried the case. (*Reg.* v. *Nation*, Taunton Spring Assizes, 1857, see p. 279; also, 'Med. Times and Gazette,' April 11, 1857, p. 365.) For information on this subject, see Ritter's Prize Essay, 'Ueber die Ermittelung der Blutflecken in Kriminalfällen,' Wurzberg, 1854, and Friedberg's 'Histologie des Blutes,' Berlin, 1852. These authors affirm, from their observations, that it is not possible to distinguish by the microscope human from animal blood in criminal cases. Evidence based upon such varying averages as those above given, must be treated as speculative and unsafe.

Blood-crystals. Hæmatin.—Another process for the microscopical detection of blood has been, of late years, suggested by some German medical jurists. It consists in procuring crystals from the red colouring matter of blood. Lehmann and Kunze ascertained that all red blood is capable of crystallization, from whatever animal or organ it may have been taken. Lehmann thus describes his method of procuring these hæmatin crystals. A drop of blood which has been kept a day, is allowed to evaporate on a glass slide; a drop of distilled water is then added, and the whole is covered with a slip of thin glass. After a time, when the water has to some extent evaporated, regular red-coloured crystals, of various sizes and forms, such as those represented in the quadrant *a* of Fig. 8, are visible. Some are columnar and prismatic, while others are in the form of rhombic plates. The second quadrant, *b*, represents the crystals procured by a similar process, from the heart-blood of a cat. The third, *c*, crystals from the venous blood of a Guinea pig, which appear in regular tetrahedra; and the fourth, *d*, crystals from the venous blood of a squirrel; some of which are prismatic, and others in the form of rhombic and hexahedral plates. The hæmatin crystals are represented in this and the other engravings as transparent. They are, in fact, translucent, and, under a good light, of a well-marked red or red brown colour.

Fig. 8.

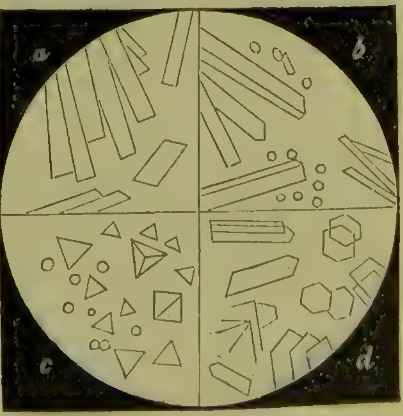
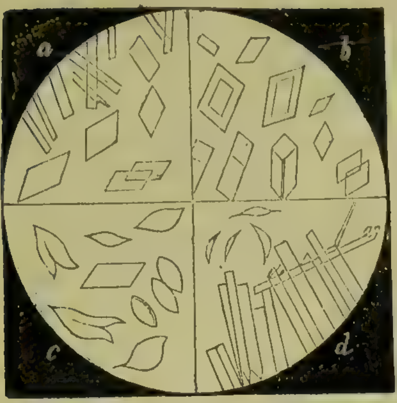


FIG. 9.



In Fig. 9 the first quadrant, *a*, shows, the prisms and rhombic plates obtained by Lehmann from human venous blood; *b*, blood-crystals from human blood in rhombic plates, as delineated by Robin and Verdeil ('Chimie Anatomique'), and *c*, crystals obtained from human blood, by Dr. Kunze, by a process described below. Some of these have a rhombic form; others are shaped like a hemp seed; and a few, being double at one extremity, have the appearance of a swallow's tail. In the quadrant *d* are represented crystals as obtained by Lehmann from the red blood of a fish. It is to be observed of these crystals that they are all coloured, having more or less the red colour of the blood in varying degrees of intensity.

In applying Lehmann's process to a fragment of a dried clot of human blood, which had been kept for six months, prismatic crystals were seen, mixed with bodies of an ovoid shape. A number of these are delineated in the annexed engraving (Fig. 10). They have the characters of the phosphates and other salts of the blood. No rhombic plates, or tetrahedra, such as those described by Lehmann, were seen. The prismatic crystals had the characters of phosphate of magnesia. They were colourless on a red ground, which owed its colour to the dissolved hæmatin.

FIG. 10.

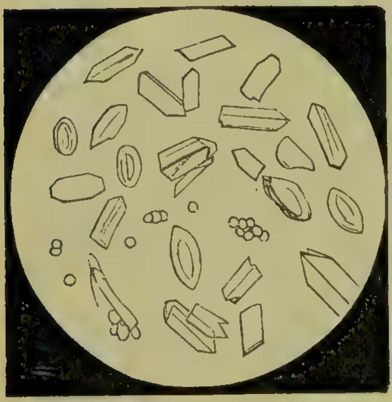
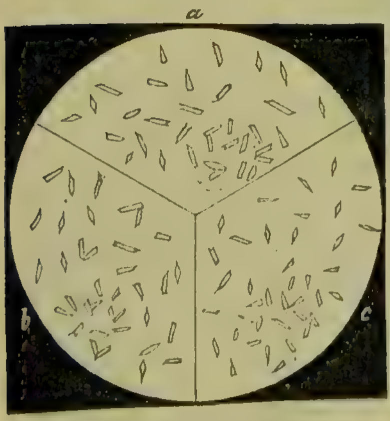


FIG. 11.



Hæmatin or blood crystals magnified 517 diameters.

The production of crystals from the colouring matter of blood, as contained in a dry coagulum, may be easily effected by a process suggested by Dr. Kunze, of Merseburg. (Casper's 'Vierteljahrschrift,' April 1864, p. 262.) This gentleman recommends the strongest glacial acetic acid. As the object is not here to search for blood-corpuscles, any stuff superficially stained, is soaked in a small quantity of water for one or two hours, until the colouring matter is dissolved, and a reddish-brown solution is obtained. The red liquid is evaporated to dryness, and the dry residue is boiled in an excess of glacial acetic acid, until the acid is strongly coloured. The acid liquid is poured off, and one or two particles of common salt are well stirred into it. It is then slowly evaporated on a slide, or on a watch-glass, at a temperature of about 180°, and the residue is examined, either in the wet or dry state, by a microscopical power of from 300 to 500 diameters. The blood-crystals, if present, then appear in groups, as small dark specks. They are somewhat irregular in shape —have generally a prismatic form, some with rhombic terminations while others assume a spindle shape, and others, again, are joined at an angle, so as to resemble a bird's tail. Kunze describes them of the form delineated in Fig. 9, *c*. In repeating Kunze's experiments, I have found that the use of common salt was not necessary. It had the effect of encumbering the field of view with cubic and other crystals of chloride of sodium. Having removed a portion of the dried coagulum from human blood, which had been kept loosely exposed for six months, I powdered it and boiled it in glacial acetic acid, in a small porcelain cup, until a quantity of colouring matter had obviously been dissolved. The acetic acid, under these circumstances, acquired a dark reddish, or reddish-brown colour. A few drops of the clear liquid, evaporated on a slide, left minute red-coloured crystalline-looking masses, like those seen in *a*, Fig. 11. They were plainly distinguishable from the cubic crystals of common salt, naturally contained in the blood, as well as from the phosphates. They varied much in size and shape, but generally assumed the form of slender prisms with irregular rhombic terminations. Hæmatin crystals, as they were thus procured from human blood, were found to have an average length of 1-2250th of an inch and a width of 1-9000th of an inch. Those obtained from sheep's blood were smaller than those obtained from the blood of man and of the bullock. A fragment of the dried blood of the bullock, which had been on a rag for about six years, gave, when similarly treated, the group of red-coloured crystals seen in *b*; and blood of the sheep of old date gave the form seen in *c*. The crystals in the latter were smaller than those produced from human and bullocks' blood, but the resemblance is so great, that it would be obviously impossible to base any distinction between human and animal blood upon such observations. The results, however, show that the colouring matter of blood thus treated, may be converted into quasi-crystalline forms, still preserving its red colour; and that microscopical evidence of blood may be thus obtained, in cases in which the blood-corpuscles have not been successfully extracted by liquids. A very small quantity of dry coagulum will suffice to yield this corroborative evidence. An additional branch of research is thereby opened to a medical jurist. The association of cubic crystals of salt with these blood-crystals, when no chloride of sodium has been added to the liquid, is an additional proof of the presence of blood, as this is one of the principal saline constituents of that fluid. In stains of old date, I have observed, in association with hæmatin crystals, dagger crystals of hydrochlorate of ammonia.

I have tried similar experiments with the colouring matters of cochineal, logwood, and kino. On treating the first with acetic acid, a pink-red colour, differing from that of blood, is produced, while the extracts of logwood and kino give a yellowish-brown colour with this acid. In no case, on evaporating the acid solutions, were any crystals resembling those of hæmatin or chloride of sodium obtained.

A singular process for detecting blood has been suggested by Van Deen. It consists in the application of guaiacum and an ozonized liquid (oil of turpentine) to a solution of the colouring matter in water, or to the stain itself on articles of clothing. Hæmatin, if present, is said to acquire a blue colour. From my experience of this process, it is liable to lead to great fallacies. The resin of guaiacum, under exposure to light, acquires a bluish-green colour when diffused through water only. Ozonized substances, such as peroxide of lead, peroxide of manganese, manganate and permanganate of potash, render the tincture blue, with or without the addition of oil of turpentine. But oil of turpentine itself frequently holds ozone dissolved, and the blue colour may thus be produced irrespective of the presence of blood or hæmatin. De Liman has shown, by a series of experiments, that some kinds of leather—decoctions of leather—Swedish blotting-paper, and several preparations of iron, produce a change of colour in the reagent, similar to that which Van Deen assigned to the hæmatin of blood. (Casper's 'Vierteljahrschrift,' 1863, vol. 24, p. 213.) My own experiments have led me to the conclusion that this change of colour in guaiacum resin is produced in many liquids and solids with or without blood when exposed to light, but it takes place more rapidly with blood than with some other substances. When, however, the mixture of blood, guaiacum, and turpentine was placed in a dark closet, there was no change of colour such as Van Deen describes. Dr. Schmidt, in 1862, announced the existence of ozone in the colouring matter of blood; but the facts which he described, like those observed by Van Deen, are not safely applicable to the medico-legal determination of the presence of blood. Dr. Stokes has pointed out a new method of examination. A dilute solution of blood, viewed by a prism through a slit, presents a peculiar spectrum, in which certain dark bands appear. These are the same, whether the blood employed is that of man or a sheep or bullock. There are great difficulties in applying this optical process to forensic investigations. (See 'Proc. R. S.,' Vol. 13, No. 66, p. 360.) Even if these did not exist, it would not lead to a more satisfactory demonstration of the presence of blood on clothing, than that which may be now obtained conjointly by chemistry and the microscope.

For further information on the subject of blood-stains, I must refer the reader to the following works. 'Ann. d'Hyg.' 1829, pp. 267, 548; 1830, p. 433; 1831, p. 467; 1833, p. 226, t. 2, p. 160; 1834, p. 205; 1835, t. 2, p. 349; 1839, t. 1, p. 219; 1840, t. 1, p. 387. Henke's 'Zeitschrift der S. A.' 1844, b. 2, p. 273, 'Guy's Hosp. Reports,' Oct. 1851. Casper's 'Vierteljahrschrift,' 1862, vol. 1, pp. 15, 250, 256, and 1863, vol. 2, p. 193.

CHAPTER 37.

IMPUTED OR SELF-INFLICTED WOUNDS—MOTIVES FOR THEIR PRODUCTION—MEDICO-LEGAL INVESTIGATION OF THESE CASES.

Imputed or self-inflicted Wounds.—The question whether a wound was or was not self-inflicted, may refer to the living as well as to the dead. Thus, a man may produce wounds upon himself for the purpose of simulating a homicidal assault, which, for various motives, he may allege to have been committed upon him. With the motives for the self-infliction of wounds, a medical jurist is not concerned—it is of the fact only that he can take cognizance. From the cases that have yet occurred, it would appear that the object has been to extort money, to conceal murder, robbery, or some other crime, and to turn away a suspicion of criminality from the wounded person. One of the most remarkable cases of this kind which have occurred in England, was that of *Bolam*, who was tried for the murder of a man named Millie, at the Newcastle Autumn Assizes, 1839. It is impossible to enter into all the particulars of this singular trial; but it may suffice to state that the prisoner Bolam was found lying in an apartment which had been fired by himself, or, as he alleged, by some incendiary, and near him was the body of the deceased, who had evidently been killed by violence—the skull having been extensively fractured by a poker lying near. The prisoner, when found, was either insensible or pretended to be so. He stated that he had been suddenly attacked by a man, and knocked down by a blow on the right temple. After attempting to escape, he was again knocked down. He then felt a knife at his throat, but admitted that he did not put up his hands to protect it. His hands were not cut. He said he remembered receiving some blows on his body, but he became insensible, and recollected nothing more. On examining his throat, there was a wound an inch and a half in length on the left side of the neck, a quarter of an inch below the jaw. It had penetrated merely through the true skin, and was of inconsiderable extent. A small quantity of blood, which had flowed down on the inside of his cravat, had escaped from this wound. There were many cuts on his coat at the back and sides, through his waistcoat, shirt, and flannel-shirt; but there were no corresponding cuts or stabs, nor, indeed, any mark of injury upon the skin. The question was, whether these wounds were inflicted by the unknown person, who was alleged to have fired the premises and murdered the deceased, or whether the prisoner had inflicted them on himself, in order to divert attention, and conceal the crime which he was accused of having committed. No motive for the imputed crime was discovered, and he had borne a very good character; but, nevertheless, the medical facts relative to the self-infliction of wounds were so strong, that he was convicted of manslaughter. There was no doubt that the prisoner had produced the wounds upon himself in order to remove the suspicion that he had caused the death of the deceased. They were superficial, involved no important organs, and bore the characters which those wounds only would have, that had not been produced with a suicidal intention.

Soon after Bolam's case, one somewhat similar occurred in London. The steward of a club-house was found one morning in bed wounded, and the cash-box of the club was missing. Circumstances led the police to suspect that no one could have broken into the house; but the man himself was considered so trustworthy, that no suspicion was entertained of his having been concerned in the robbery. The surgeon who examined him found the wounds on his person of a trivial character; and there was no doubt, from what subsequently transpired, that he had produced them on himself, for the purpose of averting suspicion.

It is not always easy to trace a motive for the production of these injuries; and when a reasonable motive is not immediately discovered, persons are apt to be misled and to credit the story. Individuals who have been convicted of thus imputing violence to others, have frequently borne a respectable character until the occurrence, and this has contributed to give support to their statements. When a person intending to commit suicide fails in the attempt, he has sometimes, under a sense of shame, attributed the infliction of a wound in his throat to another; but facts of this kind may without difficulty be cleared up by circumstantial evidence. Imputed wounds, if we except the case of an actual attempt at suicide, in which the injury is commonly severe, are generally of a *superficial* character, consisting of cuts or incisions not extending below the true skin; deep stabs are seldom resorted to where the purpose is not suicide but merely to conceal other crimes. Further, these wounds are in *front* of the person, and may be on the right or left side, according to whether the person is right or left-handed. They have also been generally *numerous*, and widely scattered; sometimes they have had a complete parallelism, unlike those which must have been inflicted by an adversary during a mortal conflict with a weapon. The *hands* are seldom wounded, although in the resistance to real homicidal attempts these parts commonly suffer most severely. The injuries are not usually situated over those parts of the body in which wounds are by common repute considered *mortal*, and there is in general an entire want of correspondence between the situation of the wounds on the person, and the cuts or other marks on the *dress*. This is a fact which requires special attention. In a case which occurred to Marc, a young man alleged that he had received a sword-cut on the forehead from some assailants who had escaped. He was allowed to relate the whole of the particulars, and they formed a romantic and improbable story. He stated that he wore at the time, a handkerchief round his head, a cotton cap, and a common cap with an elastic front, which he alleged had been cut through. There was a longitudinal wound, quite superficial and about an inch long, at the upper and right part of the frontal bone, passing downwards from *left to right.* The cut in the felt of the cap, which was very soft, passed obliquely from *right to left*, and was about three inches in length. The cut was not so clean or regular as if it had been produced by a sword; there was very little blood upon the cap, and only on the edge of the incision. The silk handkerchief was cut in an irregular manner. When the person was requested to place the cap and other articles upon his head in the position in which he stated they were when he was attacked, it was found to be utterly impossible to adjust them—the incisions could not be made to correspond, and the cap could not be worn over the folded handkerchief. This rendered it certain that the wound had not been inflicted in the manner described. Besides, a blow of a sword which would have divided the felt and silk handkerchief, would at the same time have produced a much deeper wound on the forehead than that which was found. In a case reported by Dr. Bayard, the falsehood of a similar charge was demonstrated by the want of correspondence between the cuts in the clothes and those found on the person. ('Ann. d'Hyg.' 1847, vol. 2, p. 222.)

In comparing cuts on the *dress* with wounds on the person, there are several circumstances to be attended to. What articles of dress were worn at the time of the assault? In a case of stabbing all ought to present marks of perforation, corresponding in direction, form, size, sharpness of the edges of the weapon, &c. In imputed wounds, the marks on several layers of dress may not correspond with each other in the characters above mentioned. It is very difficult for a man simulating such injuries so to arrange his clothes when off his person, as to deceive a careful examiner. There will be some inconsistency or want of adjustment. Apart from the fact that several stabs or cuts cannot exist on the same part of the clothes, without one or more being stained with blood on the outside or inside, an impostor may either do too much or too little, and thus lead to his detection. In a case which excited much public discussion in London many years since, a simple circumstance led to the inference that certain stabs or cuts through a shirt had not been produced while the shirt was on, but while it was off the body. There were two cuts in the shirt near to each other, precisely similar in size, form, and direction; in fact, the knife or dagger producing them must have gone through a fold of the shirt, so accurate was the correspondence. Then, however, it followed that the shirt could not have been upon the body of the wounded person, as he alleged, because a stab through a shirt when worn over the skin must, in order to reach the body, traverse not only a fold (producing two cuts), but another layer in contact with the skin, and thus produce *three cuts*, or in the event of traversing two folds, *five cuts*. In simulating the wounds by cuts on the shirt, the person is supposed to have forgotten this, and have merely stabbed a fold of the shirt while lying on a table, or in some situation convenient for the purpose. This, among other facts, rendered it probable that the slight wounds on the chest were self-inflicted.

It has been contended that no rules can be laid down for the detection of such cases; each must be decided by the facts which accompany it. Nevertheless, the details of those above mentioned will serve to direct the inquiries of a practitioner. The facts which he must endeavour to ascertain are the following: — 1. The relative positions of the assailant and the assailed person at the time of the alleged attack. 2. The situation, direction, and depth of the wound or wounds. 3. The situation or direction of marks of blood or wounds on the person or dress of either, or of both, the assailant and assailed. 4. The marks of blood, and the quantity effused at the spot where the mortal struggle is alleged to have taken place. The importance of these inquiries cannot be over-estimated. A strong suspicion was raised against the late Duke of Cumberland, in the year 1810, in reference to the death of *Sellis*, when a proper examination of the wounds on the deceased would have shown that they might have been self-inflicted.

It is worthy of remark, that imputed wounds are generally *cuts* or *stabs.* They are seldom of the contused kind; the impostor cannot, in reference to contusions, so easily calculate upon the amount of mischief which is likely to ensue. Dr. Bergeret, however, has related some cases in which females labouring under hysterical attacks have inflicted upon themselves severe contusions, and have charged innocent persons with attempts to murder. ('Ann. d'Hyg.' 1863, vol. 1, p. 463.) In general the inconsistency of the story is so palpable as to betray the imposture at once; but the public are easily deceived, and much prejudice is often unjustly excited against those who have been falsely accused. Slight excoriations or bruises may be magnified into marks of murderous violence, and if a medical man can be found to admit in an unqualified form that a severe blow can be inflicted and yet leave but slight marks on the skin, the charge will be considered proved against the unfortunate accused. The case of *M. Armand*, a merchant of Montpellier, who was tried at the Assizes at Aix, in March 1864, for an alleged murderous assault upon his servant Maurice Roux, furnishes a good illustration of the readiness with which the most inconsistent stories are accepted by the public when they are supported by pseudo-medical evidence. This case was rather one of imputed homicidal strangulation than imputed wounding; nevertheless a foundation was laid for medical opinions by the presence, as it was alleged, of a slight excoriation of the skin on the nape of the neck. The injury was so slight that it escaped the observation of some medical men who examined the complainant, and there could be no doubt from the facts, that it had been produced either accidentally or designedly by the complainant on himself. Several medical gentlemen, taking the man's story as true, asserted without any qualification, 1. That a blow on the nape of the neck might produce cerebral concussion and syncope. 2. That a blow to produce such effects need not be violent; and 3. That such a blow so inflicted would not always leave upon the skin marks of contusion or ecchymosis. These admissions were taken by the Court to support the man's story—that his master struck a severe blow on the back of his neck, that this had produced concussion of the brain, and that he had been insensible for many hours. ('Ann. d'Hyg.' 1864, vol. 1, p. 451.) The evidence for the defence, and chiefly that given by M. Tardieu, removed the evil effect produced by such loose medical answers as these, and satisfied the jury that the statement of the complainant was a pure fabrication. The accused was justly acquitted of the charge. Although it has been elsewhere stated that severe blows are not always attended with external marks of violence (p. 393) it by no means follows that such blows have been struck in all cases in which the skin presents a slight abrasion. This would be converting the exception into the rule, and every superficial injury might be thus distorted into a proof of the infliction of murderous violence.

Pistol-shot wounds are sometimes voluntarily inflicted for the purpose of imputing murder or extorting charity. A man intending to commit suicide by fire-arms, and failing in the attempt, may, from shame and a desire to conceal his act, attribute the wound to the hand of some assassin. In examining such imputed wounds they will not be found to involve vital parts, except in cases of attempted suicide, and they will possess all the characters of near-wounds produced by gunpowder, wadding, or a bullet. (See GUN-SHOT WOUNDS.) The skin around will be more or less lacerated and bruised; there will be much ecchymosis, and the hand holding the weapon, as well as the dress and the wounded skin, may be blackened or burnt by the exploded gunpowder. A pistol-shot wound from an assassin may be produced from a distance, while an imputed wound which is produced by a person on himself, must always partake of the characters of a near-wound. If the weapon has been charged with gun-cotton, there will be no marks of blackening on the person or dress, but there may be marks of burning.

CHAPTER 38.

THE CAUSE OF DEATH IN WOUNDS—CAUTION ON ASSIGNING TOO MANY CAUSES—WOUNDS DIRECTLY OR INDIRECTLY FATAL—DEATH FROM HÆMORRHAGE—LOSS OF BLOOD REQUIRED TO PROVE FATAL—MODIFIED BY AGE AND OTHER CIRCUMSTANCES—FATAL WOUNDS OF SMALL ARTERIES—INTERNAL HÆMORRHAGE—DEATH FROM MECHANICAL INJURY TO A VITAL ORGAN—DEATH FROM SHOCK—BLOWS ON THE ABDOMEN—FLAGELLATION—DEATH FROM NUMEROUS INJURIES WITHOUT ANY MORTAL WOUND.

Cause of Death.—It is important for a medical witness to bear in mind that in all cases of wounds criminally inflicted, the cause of death must be *certain*. No man is ever convicted upon mere medical probability. In general, there is only *one* real cause of death, although other circumstances may have assisted in bringing about a fatal result. Thus, a person cannot die of disease in the bowels and a stab in the chest at the same time, nor of apoplexy from disease and compression of the spinal marrow at the same instant. Hence it is our duty, when several apparent causes for death exist, to determine which was the *real* cause; and in stating it to the Court, to be prepared to offer our reasons for this opinion. In most cases of local injury, when a person dies speedily, there will be no great trouble in settling whether disease or the injury was the cause. A difficulty may, however, exist when a person has recovered from the first effects of a wound, and has subsequently died. Besides, there may be cases in which the cause of death, in spite of the most careful deliberation, will be still obscure; or sometimes it may happen that the death of a person appears to be as much dependent on bodily disease as on an injury proved to have been received at the time he was labouring under disease. How is an opinion to be expressed in such a case? The course which I apprehend a medical witness ought to pursue, provided he has duly deliberated on the circumstances before he appears in court, and his mind is equally balanced between the two causes, is to state at once his doubt to the jury without circumlocution, and not allow it to be extracted from him in cross-examination. It is the hesitating to assign a satisfactory cause, or the assigning of many causes for death, that gives such advantage to a prisoner's case, even when the general evidence is entirely against him. Occasionally many causes of death are assigned by a witness, among which some have a tendency to exculpate and others to inculpate the prisoner in a greater or less degree, and it is left to the jury to select from the number, one upon which to found a verdict! In a case of this kind an acquittal is commonly obtained.

Wounds directly or indirectly fatal.—A wound may cause death either *directly* or *indirectly*. A wound operates as a *direct cause of death* when the wounded person dies either immediately, or very soon after its infliction; and there is no other cause, internally or externally, to account for death. In wounds which cause death *indirectly*, it is assumed that the deceased survives for a certain period, and that the wound is followed by inflammation, suppuration, pyæmia, gangrene, tetanus, erysipelas, or some other mortal disease, which is a direct, and not an unusual consequence of the injury. Under this head may be also arranged all those cases which prove fatal by reason of surgical operations rendered imperatively necessary for the treatment of an injury—presuming that these operations have been performed with ordinary skill and care. We shall for the present consider only the direct causes of death in cases of wounds. They are three in number:—1. *Hæmorrhage*, or loss of blood. 2. *Great mechanical injury* done to an organ important to life. 3. *Shock*, or concussion, affecting the brain or spinal marrow, whereby the functions of one or more vital organs are arrested, sometimes with but slight injury to the part struck or wounded. From either of these causes, a wounded person may die immediately or within a few minutes.

1. *Death from hæmorrhage.*—Loss of blood operates by producing fatal syncope (p. 116). A quantity of blood escaping from a vessel, although insufficient to cause death by affecting the heart and circulation, may readily destroy life by disturbing the functions of the organ or part into which it is effused. Thus, a small quantity effused in or upon the substance of the brain, or at its base, may prove fatal by inducing fatal compression; and again, if, in a case of wounded throat, blood should flow into the windpipe, it may cause death by asphyxia—*i.e.*, by stopping the respiratory process (p. 116). In these cases it is obvious that the blood acts mechanically; and in respect to the last condition a medical man, unless circumspection is used, may involve himself in a charge of malapraxis. If he allows the wound to remain open, the wounded person may die through hæmorrhage—if he closes it too soon, he may die through suffocation; and, in either case, the counsel for a prisoner will not fail to take advantage of a plausible objection of this kind. In wounds of the chest, involving the heart and lungs, death is frequently due not so much to the actual quantity of blood effused, as to the pressure which it produces upon these organs. A few ounces effused in the cavity of the membrane including the heart (pericardium), will entirely arrest the action of this organ.

The absolute *quantity of blood* required to be lost in order to prove fatal, will, of course, vary according to numerous circumstances. The young, the aged, they who are labouring under infirmity or disease, will perish sooner from loss of blood than others who are healthy and vigorous. Females, cæteris paribus, are more speedily destroyed by bleeding than males. Infants are liable to die from this cause, as a result of slight wounds. An infant has been known to bleed to death from the bite of a single leech, or from the simple operation of lancing the gums. Even the healthy and vigorous, when their vital powers have been depressed by maltreatment or by brutal violence, will sink under the loss of a comparatively small quantity of blood. (See 'Watson on Homicide,' p. 90.) A medical jurist must not forget that some persons have a predisposition to excessive bleeding from slight injuries; and this condition is often hereditary. The slightest wound or puncture—the bite of a leech or the extraction of a tooth—will be attended with a loss of blood which cannot be arrested, and which will slowly lead to death by exhaustion. Cases have been frequently recorded in our medical journals of fatal hæmorrhage following the extraction of teeth, when there had been previously nothing to indicate the probable occurrence of death from so trivial a cause. (For striking instances of this remarkable tendency to hæmorrhage in a family, see 'Brit. and For. Med. Rev.,' vol. 17, p. 247; also, 'Med. Gaz.' May 1842.) In the thirty-ninth volume of the latter journal, p. 86, a case is reported by Mr. Druitt, in which an unusual degree of bleeding followed a compound fracture of the leg. Such cases are without difficulty detected; since a surgeon may always infer, from the part injured and the extent of the injury, whether the bleeding is likely to be copious or not. When a person bleeds to death from what would, under common circumstances, be a simple wound, the admission of this fact may in certain cases lessen the responsibility of an accused party.

A *sudden loss* of blood has a much more serious consequence than the same quantity lost slowly. A person may fall into a fatal syncope from a quantity of blood lost in few seconds, which he would have been able to bear without sinking had it escaped slowly. This is the reason why the wound of an artery proves so much more rapidly fatal than that of a vein. Death speedily follows the wound of a large artery like the carotid; but it takes place with equal certainty, although more slowly, from wounds of smaller arteries. In a case in which one of the intercostal arteries was wounded by a small shot, hæmorrhage caused death in thirty-eight hours. The loss of blood which follows the division of the smaller branches of the external carotid artery, is often sufficient to destroy life, unless timely assistance be rendered. A case was tried at the Berkshire Spring Assizes, 1832, in which it was proved that the prisoner had killed his wife by stabbing her in the leg; a small artery (the anterior tibial) was divided, and the woman died from hæmorrhage half an hour afterwards. Wounds of arteries, even smaller than these, might in some subjects prove fatal, if no assistance were at hand. Mr. Watson mentions a case in which the internal mammary artery on the left side was divided by a stab in the chest. The woman died on the ninth day, and four pounds of blood were found effused on that side. In another case in which an intercostal artery was divided, six pounds of blood were effused. (Op. cit. 101.) In both cases, as in most wounds of the chest, the blood not only affected the system by its loss, but by its compressing the lungs and impeding respiration. Wounds of large veins, such as the jugular, may, from the quantity of blood suddenly lost, speedily destroy life. If a wound is in a vascular part, although no vessel of any importance be divided, the person may die from bleeding. It is difficult to say what quantity of blood should be lost, in order that a wound may prove fatal. The whole quantity contained in the body of an adult is calculated at about one-fifth of its weight—*i.e.*, about thirty pounds; of this, one-fourth is considered to be arterial, and the remaining three-fourths are venous blood. Some physiologists have estimated the proportion as one-eighth of the weight of the body. ('Med. Times and Gaz.,' Aug. 28, 1858, p. 232.) According to Mr. Watson, the loss of from five to eight pounds is sufficient to prove fatal to adults. But while this may be near the truth, many persons will die from a much smaller quantity; the *rapidity* with which the effusion takes place having a considerable influence. It has been found, by experiment, that a dog cannot bear the loss of more blood than is equivalent to one-twelfth part of the weight of its body.

Internal hæmorrhage.—Hæmorrhage may prove fatal, although the blood does not visibly escape from the body. In incised wounds, the flow externally is commonly abundant; but in contused, punctured, and gun-shot wounds, the effusion may take place internally and rapidly cause death. In severe contusions, or contused wounds, involving highly vascular parts, the effusion may go on to an extent to prove fatal, either in the cavities of the body or throughout the cellular membrane and parts adjacent; many pounds of blood may thus be slowly or rapidly effused. The most fatal internal hæmorrhages are those which follow ruptures of the organs from violence or disease. Ruptures of the heart, lungs, liver, and kidneys, have thus caused death. In November 1864, a man who had been run over was brought to Guy's Hospital. He complained of pain in the back, but there were no symptoms of severe injury, and no marks of violence were seen on the skin of the back. He left the hospital and walked with some assistance to his home. A few hours afterwards he was found dead in bed. On inspection there was a large quantity of blood effused in the abdomen. This had proceeded from one kidney, which had been ruptured transversely through its whole substance. In these cases the hæmorrhage is not immediate. Slight muscular exertion may accelerate it and cause death. In death from severe flagellation, blood may be effused in large quantity beneath the skin and among the muscles; this effusion will operate as fatally as if it had flowed from an open wound.

The means of ascertaining whether a person has died from bleeding by an open wound are these:—Unless the wound is situated in a vascular part we shall find the vessel or vessels from which the blood has issued, divided—the neighbouring vessels empty, and the body more or less pallid; although this last condition is of course liable to be met with in certain cases of disease, as also under copious venesection—points easily determined by an examination. The blood will commonly be found more or less clotted or coagulated on those surfaces on which it has fallen. If, with these signs, there is an absence of disease likely to prove rapidly fatal, and no other probable cause of death is apparent, it may be fairly referred to loss of blood. This opinion may, however, be materially modified in reference to open wounds, by the fact of the body not being seen on the spot where the injury was actually inflicted—by the wound having been sponged—the blood removed by washing, and all traces of bleeding destroyed. Under these circumstances, the case must in a great measure be made out by presumptive proof; and here a medical witness may have the duty thrown upon him of examining articles of dress, furniture, or weapons, for marks or stains of blood.

It must not be supposed that all the blood met with round a wounded dead body, or in a cavity of the body, was actually effused during life. As soon as the heart's action ceases, the arteries pour out no more; but the blood, so long as it remains liquid, *i.e.*, from four to eight or ten hours, and the warmth of the body is retained, continues to drain from the divided veins and smaller vessels. The quantity thus lost, however, is not considerable, unless the veins implicated are large, or the part is highly vascular, *i.e.*, full of small vessels.

2. *Death from great mechanical injury done to a vital organ.*—We have instances of this becoming a direct cause of death in the crushing of the heart, lungs, or brain, by any heavy body passing over or falling on the cavities, as in railway accidents. The severe mechanical injury is sometimes accompanied by a considerable effusion of blood, so that the person really dies from hæmorrhage; but in other instances the quantity of blood lost is inconsiderable, and the fatal effects may be referred to shock. Sometimes a slight amount of violence may prove fatal. These are, however, to be regarded as exceptional instances. (See case by Mr. Annan, 'Medical Times and Gazette,' August 1854.)

3. *Death from shock.*—This is sometimes a direct cause of death under the infliction of external violence; and in this case life is destroyed without the injury being to all appearance sufficient to account for so speedily fatal a result. Mr. Savory has suggested that death from shock is nothing more than death from temporary exhaustion of nerve-force, the result of a violent, sudden, and excessive expenditure of it. ('Lectures on Life and Death,' p. 171.) Whatever theory may be adopted to explain it, there is no medical doubt that a person may die from what is termed shock, without any marks of severe injury being discovered on his body after death. We have examples of this mode of death in accidents from lightning, or from severe burns or scalds, in which the local injury is often far from sufficient to explain the rapidly fatal consequences. As instances of this form of death from violence, may be also cited those cases in which a person has been suddenly killed by a blow upon the upper part of the abdomen or on the pit of the stomach,

which is supposed to operate by producing a fatal impression on the nerves and nerve-ganglia of the cardiac plexus. Whether this be or be not the true explanation, it is admitted by experienced surgeons, that a person may die from so simple a cause without any mark of a bruise externally, or physical injury internally to account for death. On the skin there may be some abrasion or slight discolouration; but as it has been elsewhere stated, these are neither constant nor necessary accompaniments of a blow. (An account of the appearances observed in a case of this kind, by Mr. Wood, will be found in the 'Medical Gazette,' vol. 44, p. 213.) Convictions for manslaughter have taken place, when death has been produced under these circumstances. (See 'Travers on Constitutional Irritation,' p. 432; and B. Cooper's 'Lectures on Surgery,' p. 443; Wounds of the Abdomen, *post*; also 'Watson on Homicide,' p. 75.) Concussion of the brain, unattended by visible mechanical injury, furnishes another example of this kind of death. A man receives a severe blow on the head; he falls dead on the spot, or becomes senseless and dies in a few hours. On an inspection, there may be merely the mark of a bruise on the scalp; in the brain there may be no rupture of vessels or laceration of substance, and all the other organs of the body are found healthy. In certain railway accidents persons have died under somewhat similar circumstances. There has been no physical indication of a mortal injury, and no cause apparent to account for death. This can be referred only to the shock or violent impression which the nervous system has sustained from the blow or violence—an impression which the vital powers were wholly unable to counteract or resist. A medical witness must give his evidence with caution in such cases; since it is the custom to rely in the defence upon the absence of any visible *mortal* wound or physical injury to account for death, as a proof that no injury was done—a principle which, if once unrestrictedly admitted, would leave a large number of deaths, undoubtedly occurring from violence, wholly unexplained. A trial took place at the Liverpool Autumn Assizes, 1837, wherein several persons were charged with the manslaughter of the deceased, by kicking him behind the right ear. The medical witness deposed that there was in this spot the mark of a severe contusion, but there was no injury whatever to the brain, and the body was otherwise healthy. He very properly ascribed death to the violent shock given to the nervous system, and the Court admitted that the cause of death was satisfactorily made out. The person who inflicted the wound was convicted.

There is another form of shock, which is of some importance in medical jurisprudence. A person may have received *many injuries*, as by blows or stripes, not one of which, taken alone, could, in medical language, be termed mortal; and yet he may die directly from the effects of the violence, either on the spot, or very soon afterwards. In the absence of any large effusion of blood beneath the skin, death is commonly referred to exhaustion, but this is only another mode of expression; the exhaustion is itself dependent on a fatal influence or impression produced on the nervous system. A prizefighter, after having, during many rounds, sustained numerous blows on the body, may, either at or after the fight, sink and die exhausted. His body may present marks of bruises, or even lacerated wounds, but there may be no internal changes to account for death. In common language, there is not a single injury which can be termed *mortal*; and yet, supposing him to have had good health previously to the fight, and all marks of disease indicative of sudden death to be absent, it is impossible not to refer his death to the direct effect of the violence. It is a well-ascertained medical fact, that a number of injuries, each comparatively slight, are as capable of operating fatally, as any single wound whereby some blood-vessel or organ important to life is directly affected. Age, sex, constitution, and a previous state of health or disease, may accelerate or retard the fatal consequences.

A case of a somewhat similar kind may present itself in the punishment of *flagellation*, which is occasionally followed by death, either as a direct consequence of shock, or from indirect causes, such as inflammation and its consequences. At the trial of *Governor Wall*, the judge directed the jury that the long continuance and severity of pain (in flagellation) may be productive of as fatal consequences as if instruments or weapons of a destructive kind were used. It is not often that scholastic flagellation is a cause of death in this country. One case, however, which occurred a few years since, excited public attention from the atrocity of the circumstances attending it. It was the subject of a trial for manslaughter at the Lewes Autumn Assizes, 1860 (*Reg.* v. *Hopley*). The evidence showed that the prisoner had beaten deceased, a youth of sixteen, most severely for nearly two hours with a rope and stick. The external wounds were slight, but an inspection showed that the muscles as well as all the soft parts beneath the skin had been considerably bruised and lacerated, and that there were extensive effusions of blood in the cellular membrane of the arms and legs. There was no mortal wound in the common sense of the term, but there was no reasonable doubt that the deceased had died from the violence inflicted on him by the prisoner. His guilt was established by the fact that he had endeavoured to conceal the effects of his violence by removing the marks of blood—that he had covered the body of the deceased with clothing so as to conceal the bruises—that he had procured a coroner's inquest to be held in haste, and while concealing from the jury the fact that he had beaten the youth on the night of his death, stated that he had found him dead, and suggested that he might have died of disease of the heart. There can be no doubt, from the medical facts of this case, that the deceased died either while the prisoner was inflicting the violence or soon afterwards. (See p. 40.) No attempt was made to dispute the cause of death. Apart from the depressing effects on the nervous system of long-continued and severe pain there was, in this instance, such an effusion of blood internally as would account for the production of fatal syncope.

On a trial for murder, which took place in Germany, it was proved that the deceased had been attacked with sticks, and that he had been afterwards flogged on the back with willow switches. He died in about an hour. On inspection, there was no mortal wound, nor any injury to a vital organ; there were simply the marks of lacerations and bruises on the skin, apparently not sufficient to account for death—but this was, nevertheless, very properly ascribed to the violence. (Henke, 'Zeitschrift der S. A.' 1836; also 'Brit. and For. Med. Rev.,' Jan. 1837, p. 249.) The case of the *Duchess of Praslin*, who was murdered by her husband in Paris, in August 1847, furnishes an additional proof of the fatal effects produced by numerous injuries. On an inspection of the body, it was found that on the head, neck, and both of the hands, there were no fewer than *thirty* distinct wounds, some contused, and others incised and punctured. There were also the marks of many bruises, and the impressions produced by the nails of the assailant's hand over the mouth. For the most part these injuries were slight, and not one could be said to be necessarily mortal. The most serious wound was situated on the right side of the neck; but even here the carotid artery and internal jugular vein had escaped injury. Death was referred to the loss of blood which had taken place from the numerous wounds inflicted during the struggle with the assassin. ('Ann. d'Hyg.' 1847, vol. 2, p. 377.) From these considerations, it is obviously absurd to expect that in every case of death from violence or maltreatment, there must be some specific and visible *mortal injury* to account for that event. When the circumstances accompanying death are unknown, a medical opinion should certainly be expressed with caution; but if we are informed that the deceased was in ordinary health and vigour previous to the infliction of the violence, and there is no morbid cause to account for his *sudden* illness and death, there is no reason why we should hesitate in referring death to the effects of a number of injuries. Among non-professional persons an unfounded prejudice exists that no person can die from violence unless there be some distinctly *mortal* wound actually inflicted on the body. By this we are to understand a *visible* mechanical injury to some organ or blood-vessel important to life; but this is obviously an erroneous notion, since death may take place from the disturbance of the functions of an organ important to life without this being necessarily accompanied by a perceptible alteration of structure. The prevalence of this popular error often leads to a severe cross-examination of medical witnesses. Among the questions put, we sometimes find the following:—Would you have said, from the wounds or bruises *alone*, that they were likely to have occasioned death? Now, in answer to this, it may be observed, that we cannot always judge of the probability of death ensuing from the appearance of external violence alone. Because the appearances were slight, it would be wrong to infer that they were *not* sufficient to cause death by shock. Then it may be inquired, Were the wounds or bruises mortal? In the vulgar sense of the word, *i.e.*, by producing great loss of blood, or a destruction of parts, they might not be so; but in a medical view, they may have acted mortally by producing a shock to the nervous system. Again it may be inquired, Which of the several wounds or bruises found on the body of the deceased was mortal? The answer to this question may be—Not one individually, but *all* contributed to occasion death by syncope or exhaustion. It must be remembered, that in cases in which a person has sustained a number of injuries, the loss of a much smaller quantity of blood than in other instances, will suffice to destroy life.

It is sometimes a difficult question to decide on the relative degree of mortality of several wounds, and on the share which they have had respectively in causing death. By a wound being of itself *mortal*, we are to understand that it is capable of causing death directly or indirectly, in spite of the best medical assistance. It is presumed that the body is healthy, and that no cause has intervened to bring about or even accelerate a fatal result. The circumstance of a person labouring under disease when wounded in a vital part, will not, of course, throw any doubt upon the fact of such a wound being necessarily mortal, and of its having caused death. If there should be more wounds than one, it is easy to say, from the nature of the parts involved, which was likely to have led to a fatal result. In order to determine, on medical grounds, whether a wound was or was not mortal, we may propose to ourselves this question: Would the deceased have been likely to die at the same time, and under the same circumstances, had he not received the wound? There can obviously be no general rule for determining the mortal nature of wounds. Each case must be judged by the circumstances which attend it. In some continental states, the law requires that a medical witness should draw a distinction between a wound which is *absolutely* and one which is *conditionally* mortal. An absolutely mortal wound is defined to be that in which the best medical assistance being at hand, being sent for, or actually rendered, the fatal event could not be averted. Wounds of the heart, aorta, and internal carotid arteries, are of this nature. A conditionally mortal wound is one in which, had medical assistance been at hand, been sent for, or timely rendered, the patient would, in all probability, have recovered. Wounds of the brachial, radial, and ulnar arteries may be taken as instances. The responsibility of an assailant is made to vary according to the class of injuries to which the wound may be referred by the medical witnesses; and, as it is easy to suppose, there is seldom any agreement on this subject. Our criminal law is entirely free from such subtleties. The *effect* of the wound, and the *intent* with which it was inflicted, are looked to: its anatomical relations, which must depend on pure accident, are never interpreted in the prisoner's favour. Some extenuation may, perhaps, be occasionally admitted when a wound proves mortal through an indirect cause, as inflammation or fever, and medical advice was obtainable, but not obtained until every hope of recovery had disappeared. It appears, however, from the case of the *Queen* v. *Thomas and others* (Gloucester Aut. Ass., 1841), that the mere neglect to call in medical assistance is not allowed in law to be a mitigatory circumstance in the event of death ensuing. The deceased died from the effects of a severe injury to the head, inflicted by the prisoners, but had had no medical assistance. The judge said it was possible that, 'if he had had medical advice, he might not have died; but whoever did a wrongful act must take the whole consequences of it. It never could make any difference whether the party injured had or had not the means or the mind to apply for medical advice.' The prisoners were convicted. According to Lord Hale, if a man be wounded, and the wound, although not in itself mortal, turn to a gangrene or fever for want of proper applications, or from neglect, and the man die of gangrene or fever, this is homicide in the aggressor; for though the fever or gangrene be the immediate cause of death, yet the wound being the cause of the gangrene or fever is held the cause of death, *causa causati.* These nice questions relative to the shades of responsibility for personal injuries, occasionally arise in cases in which persons have been wounded at sea on board of a ship in which there was no surgeon.

CHAPTER 39.

DEATH OF WOUNDED PERSONS FROM NATURAL CAUSES—DISTINCTION BETWEEN REAL AND APPARENT CAUSE—DEATH FROM WOUNDS OR LATENT DISEASE—ACCELERATING CAUSE—WHICH OF TWO WOUNDS CAUSED DEATH?—DEATH FOLLOWING SLIGHT PERSONAL INJURIES.

Death of wounded persons from natural causes.—It is by no means unusual for individuals who have received a wound, or sustained some personal injury, to die from latent natural causes; and as, in the minds of non-professional persons, death may appear to be a direct result of the injury, the case can only be cleared up by the assistance of a medical practitioner. Such a coincidence has been witnessed in many instances of attempted suicide. A man has inflicted a severe wound on himself while labouring under disease; or some morbid change, tending to destroy life, has occurred subsequently to the infliction of a wound, and death has followed. Without a careful examination of the body, it is impossible to refer death to the real cause. The importance of an accurate discrimination in a case in which wounds or personal injuries have been caused by another, must be obvious on the least reflection. A hasty opinion may involve the accused in a charge of manslaughter; and although a barrister might be able to show on the trial that death was probably attributable not to the wound, but to coexisting disease, yet it must be remembered, that the evidence of a surgeon before a coroner or magistrate, in remote parts of this country, may be the means of causing the person charged to be imprisoned for some months previously to the trial. This is in itself a punishment, independently of the loss of character to which he must be in the meantime exposed. In 'Guy's Hospital Reports,' October

1850, p. 230, will be found two cases communicated to me by Mr. Procter, of York, in which death from natural causes was wrongly assigned to violence. In a case reported by Dr. Berncastle ('Lancet,' Feb. 15, 1845, p. 185), the deceased, a boy, died from an internal strangulation of the intestine from morbid causes, after wrestling with another boy, who might, but for the careful inspection, have been erroneously charged with having caused his death. (For a similar case, see 'Medical Gazette,' vol. 37, p. 702; also 'Casper's Wochenschrift,' May 24, 1845.)

Death from wounds or latent disease.—A natural cause of death may be lurking within the body at the time that a wound is criminally inflicted, and a close attention to the symptoms preceding and the appearances after death can alone enable a surgeon to distinguish the real cause. A man may be severely wounded, and yet death may take place from rupture of the heart, the bursting of an aneurism, from apoplexy, phthisis, or other morbid causes which it is here unnecessary to specify. ('Cormack's Ed. Jour.' May 1846, p. 343.) If death can be clearly traced to any of these diseases by an experienced surgeon, the prisoner cannot be charged with manslaughter; for the medical witness may give his opinion that death would have taken place about the same time and under the same circumstances whether the wound had been inflicted or not. The case of *Colonel Gordon*, which occurred in April 1854, proves that slight causes may lead to death, when there is latent disease of the heart or any other important organ. This case was the subject of a trial at the Chester Lent Assizes, 1854 (*Reg.* v. *Sandars*). It appeared from the evidence, that the accused, who was the conductor of a railway train in which deceased was travelling, attempted to eject him from a carriage. The deceased resisted, and in the struggle the prisoner struck him on the left arm. The deceased made no further resistance, but sat quietly in his seat. It was soon afterwards perceived that he was dead. The medical evidence showed that there was ossification of the valves of the heart and aorta, and that this disease had been of long standing. The life of the deceased was at all times in great peril, and his death might have arisen from the excitement which took place previous to the prisoner laying hands upon him. It might have followed in the course of half an hour. As it was thus admitted that excitement alone would account for the fatal result, the prisoner was acquitted. There was no *corporeal* injury done to the deceased which could account for death.

In another case, which was the subject of a trial at the Central Criminal Court, in June 1854 (*Reg.* v. *Champlonier*), appearances sufficient to account for death existed in the part which sustained the violence; but the medical witness could not with certainty refer them to the violence. An old man passing along a road was struck on the forehead by a stone thrown by the prisoner. The surgeon stated that there was a contused wound, and that his nose bled profusely. The bleeding was arrested, and on the following day he considered the deceased to be out of danger. At a later period of the day, however, the deceased was seized with an apoplectic fit, from which he did not recover. The appearances in the brain were quite sufficient to account for death; but he could not undertake to say that the injury by the stone had in any way produced these appearances. Upon this evidence the supposed connection of the death with the violence was at once set aside as too remote, and the prisoner was discharged.

On these occasions, one of the following questions may arise:—Was the death of the person accelerated by the wound, or was the disease under which he was labouring so aggravated by the wound as to produce a more speedily fatal termination? The answer to either of these questions must depend on the circumstances of each case, and the witness's ability to draw a proper conclusion from these circumstances. The maliciously accelerating of the death of another already labouring under disease is criminal; for in a legal sense that which accelerates, causes. Lord Hale, in remarking upon the necessity of proving that the *act* of a prisoner caused the death of a person, says:—'It is necessary that the death should have been occasioned by some corporeal injury done to the party by force, or by poison, or by some mechanical means which occasion death; for although a person may, *in foro conscientiæ*, be as guilty of murder by working on the passions or fears of another, and as certainly occasion death by such means, as if he had used a sword or pistol for the purpose, he is not the object of temporal punishment.' (I. 247.) Several acquittals have taken place of late years, in cases in which the deaths of parties had been occasioned by terror, or dread of impending danger, produced by acts of violence on the part of the prisoners; not, however, giving rise to bodily injury in the deceased. Conformably to Lord Hale's view, the Criminal Law Commissioners, in their report on the subject of homicide, state:—'Art. 1. The law takes no cognizance of homicide unless death result from *bodily injury* occasioned by some act or *unlawful omission*, as contradistinguished from death occasioned by an influence on the mind, or by any disease arising from such influence.' 'Art. 2. The terms "unlawful omission" comprehend every case where anyone being under legal obligation to supply food, clothing, or other aid and support, or to do any other act, or make any other provision for the sustentation of life, is guilty of any breach of such duty.' Under the statute (1 Vict. c. 85, s. 2) it appears from the following case that physical injury only is intended. In *Reg.* v. *Grey* (Huntingdon Lent Assizes, 1857), the prisoner was indicted for causing a bodily injury dangerous to life—to wit, a congestion of the lungs and heart, with intent to murder. It appeared that she had exposed her child to cold and wet, and that congestion or inflammation of the lungs was a result of such exposure. Erle, J., held that the statute under which the indictment was laid contemplated the infliction of some wound or visible injury to the person. The woman was found guilty; but in June 1857, the point having been reserved, the conviction was quashed by the Court for Crown Cases reserved, on the ground that, looking to the other offences provided for in this statute, this case did not come within it. In *Reg.* v. *Percival* (Midland Circuit, March 1857), a man was charged with the manslaughter of deceased by causing his death by fright, *i.e.*, by personating a ghost. The evidence showed that the boy had sustained no physical injury, but he had received a shock from which he did not recover. Wightman, J., held that in his view the case would fall within the definition of manslaughter. Under the 14 and 15 Vict., c. 100, the necessity for tracing death to some *corporeal* injury appears to be practically abolished. According to the fourth section, in any further indictment for murder or manslaughter it shall not be necessary to set forth the *manner* or the *means* by which the death of the deceased was caused.

Which of two wounds caused death.—It is possible that a man may receive *two wounds* on provocation, at different times, and from different persons, and die after receiving the second: in such a case, the course of justice may require that a medical witness should state which wound was the cause of death. Let us take the following illustration:—A man receives during a quarrel a gun-shot wound in the shoulder. He is going on well, with a prospect of recovery, when in another quarrel he receives a severe penetrating wound in the chest or abdomen from another person, and after lingering under the effects of these wounds for a longer or shorter period, he dies. If the gun-shot wound was clearly shown to have been the cause of death, the second prisoner could not be convicted of manslaughter; or if the stab were evidently the cause of death, the first prisoner would be acquitted on a similar charge. It might be possible for a surgeon to decide the question summarily, when, for instance, death speedily followed the second wound; and on inspection of the body, the heart or a large vessel is discovered to have been penetrated; or, on the other hand, extensive sloughing sufficient to account for death, might take place from the gun-shot wound, and on inspection, the stab might be found to be of a slight nature,—not involving any vital parts. In either of these cases, all would depend upon the science, skill, and judgment of the medical practitioner,—his evidence would be so important that no correct decision could be arrived at without it; he would be, in fact, called upon substantially to distinguish the guilty from the innocent. On some occasions death may appear to be equally a consequence of either or both of the wounds; in which case, probably both parties would be liable to a charge of manslaughter. (See 'Ann. d'Hyg.' 1835, vol. 2, p. 432.) The second wound, which is here supposed to have been the act of another, may be inflicted by a wounded person on himself, in an attempt at suicide, or it may have an accidental origin. The witness would then have to determine whether the wounded person died from the wound inflicted by himself or from that which he had previously received. (See *Tetanus*, *post.*)

It may happen that the wounded person has taken *poison*, and has actually died from the effects, and not from the injuries or maltreatment. Again, a wounded person may have been the subject of subsequent ill-treatment, and the question will arise—to which of the two causes his death was really due. It is to be observed of these cases, that the supervening disease, the poison, or the subsequent ill-treatment, should be of such a nature as to account for *sudden or rapid death*; since it would be no answer to a charge of death from violence, to say that there were marks of chronic disease in the body, unless it was of such a nature as to account for the sudden destruction of life under the symptoms which actually preceded death. In the medical jurisprudence of wounds, there is probably no question which so frequently presents itself as this: it is admitted that the violence was inflicted, but it is asserted that death was due to some other cause, and the onus of proof lies on the medical evidence. Among numerous cases which have occurred in England during the last twenty years, I find that the latent causes of death in wounded persons have been chiefly inflammation of the thoracic or abdominal viscera, of apoplexy, diseases of the heart and large blood-vessels, phthisis, ruptures of the stomach and bowels from disease, internal strangulation, and the rupture of deep-seated abscesses. In some of these cases the person was in a good state of health up to the time of the violence, and in others there was a slight indisposition. The history is nearly the same in all: it was only by careful conduct on the part of the medical witnesses that the true cause of death was ascertained. It is obvious that questions of malapraxis and life-insurance, giving rise to civil actions, may have a close relation to this subject.

Death following slight personal injuries.—An imputation has occasionally been thrown on the master of a school, when a boy has died soon after he has been punished in an ordinary way, and when there has been no suggestion that an undue amount of violence was used. In such cases there has been commonly some unhealthy state of the body to explain the result. When the disease which gives rise to doubt is seated in a part which is remote from that which sustained the violence, all that is required is, that the examination of the body should be conducted with ordinary care. If the disease should happen to be in the part injured (the head or chest), the case is more perplexing. The difficulty can then be removed only by attentively considering the ordinary consequences of such injuries. The violence may have been too slight to account for the diseased appearance; and the disease itself, although situated in the part injured, may be regarded as an unusual consequence of such an injury. On the other hand, the presence of chronic disease will form no exculpation of acts of violence of this nature. In *Reg.* v. *Hopley*, p. 471, there was chronic disease of long standing in the brain of deceased, but it was proved that he was quite well and suffered from no unusual symptoms up to the time that the violent flogging was inflicted, and that this was followed by death in less than three hours from the commencement of the violence. It was not here a question even of acceleration, for the deceased might have lived for years in spite of the existence of this chronic disease.

In some cases, slight blows have been followed by fatal consequences, even when no disease existed to account for the result. Mr. Annan describes a case in which a healthy girl of four received a slight blow on the shin, about three inches below the knee, from the shaft of a wheelbarrow. There was pain but no external mark of violence. The injury was considered to be so slight as to require no special treatment. On the following day there was increased pain. Severe constitutional symptoms set in, and the child died on the fourth day. ('Med. Times,' August 1854.)

The following cases furnish additional illustrations of death after slight personal injuries, in which the medico-legal question requiring solution was simply, whether the death was a sequence or consequence of the violence:—A boy was struck two blows on the face by a magistrate; but it did not appear that they were very severe. The boy went to his work on the following day, but complained of pain in his head: he continued to work for two days, when he was seized with such severe pain that he was obliged to keep his bed. He became worse, and died fourteen days after the injury. A minute inspection of the body was made, but the only morbid appearance found, was a small tumour on the outer membrane of the brain, corresponding to the posterior face of the petrous portion of the right temporal bone. This satisfactorily accounted for death, but the examiners very properly denied that it had proceeded from the violence, because, 1, the tumour had evidently been for a long time forming; and many months before he was struck, the deceased had complained of his head. 2. It was also wholly improbable that the slight blows should, under any circumstances, have given rise to the formation of this deep-seated fungous excrescence. (Henke, 'Zeitschrift der S. A.' 1837.) A case illustrative of these singular coincidences, is reported to have been the subject of a criminal trial in the United States in 1842. A man was stabbed by his wife during a quarrel at a theatre, and he died in about ten minutes. It was supposed that the deceased had died from his wounds, which consisted of two stabs on the right arm, and one in the region of the stomach: and the prisoner, who believed that she had caused her husband's death, was charged with the murder. From the medical evidence given at the trial, it appeared that there was a large quantity of blood effused in the abdomen, and that the weapon had only perforated the stomach, without dividing any considerable blood-vessel to account for such a copious effusion. It was found that this had proceeded from the rupture of a large aneurism of the aorta, the walls of which were so much thinned, that the least excitement was, in the opinion of the witness, sufficient to cause the accident. The tumour was out of the reach of the knife, which had not penetrated in the direction in which it was lying. The witness admitted that wounds of the stomach were always dangerous, but that sudden death was not a usual consequence of a slight puncture. The prisoner was acquitted. In other instances the case may be of a very doubtful character. A good illustration of this will be found in the Med. Gaz. Vol. 20, p. 503, in a case reported by the late Dr. Hughes, where a boy died apparently from the effects of a blow on the side; and after death, peritonitis, ulceration of the bowels, an aperture in the diaphragm, and gangrene of the lungs were found. The following case, related by Morgagni, is remarkable in this point of view. An old man was caught in the act of robbing an orchard: he attempted to escape, but while running away the owner struck him a blow on the back. The old man went on a few yards, and then fell dead. On inspecting the body, there were no external marks of violence. There was a large effusion of blood in the chest, which was traced to a rupture of the aorta, probably from the vessel being in an aneurismal state. The blow appeared to have been slight, and would probably have produced no evil consequences in a healthy person. (Barzellotti 'Questioni di Medicina Legale.')

CHAPTER 40.

WOUNDS INDIRECTLY FATAL—DEATH FROM WOUNDS AFTER LONG PERIODS—SECONDARY CAUSES OF DEATH—THE CAUSE IS UNAVOIDABLE—THE CAUSE AVOIDABLE BY GOOD MEDICAL TREATMENT—COMPARATIVE SKILL IN TREATMENT—CAUSE AVOIDABLE BUT FOR IMPRUDENCE ON THE PART OF THE WOUNDED PERSON—ABNORMAL OR UNHEALTHY STATE OF THE BODY—ACCELERATION OF DEATH.

Wounds indirectly fatal.—Certain kinds of injuries are not immediately followed by serious consequences, but a wounded person may die after a longer or shorter period of time, and his death may be as much a consequence of the injury as if it had taken place on the spot. The aggressor, however, is just as responsible as if the deceased had been directly killed by his violence, provided the fatal result can be traced to the usual and probable consequences of the injury. Wounds of the head are especially liable to cause death insidiously,—the wounded person may in the first instance recover,—he may appear to be going on well, when, without any obvious cause, he will suddenly expire. It is scarcely necessary to observe, that in general an examination of the body will suffice to determine whether death is to be ascribed to the wound or not. In severe injuries affecting the spinal marrow, death is not an immediate consequence, unless that part of the organ which is above the origin of the phrenic nerves (supplying the diaphragm) is wounded. Injuries affecting the lower portion of the spinal column do not commonly prove fatal until after some days or weeks; but the symptoms manifested by the patient during life, as well as the appearances observed in the body after death, will sufficiently connect the injury with that event. Death may follow a wound, and be a consequence of that wound, at almost any period after its infliction. It is necessary, however, in order to maintain a charge of homicide, that death should be strictly and clearly traceable to the injury, and not be dependent on any other cause. A doubt on this point must, of course, lead to an acquittal of the accused.

Death from wounds after long periods.—Many cases might be quoted in illustration of the length of time which may elapse before death takes place from certain kinds of injuries,—the injured person having ultimately fallen a victim to their indirect consequences. A case is related by Sir A. Cooper, of a gentleman who died from the effects of an injury to the head received about *two years* previously. The connection of death with the wound was clearly made out by the continuance of the symptoms of cerebral disturbance during the long period which he survived. Another case is mentioned by Hoffbauer, in which a person died from the effects of concussion of the brain as the result of an injury received eleven years before. ('Ueber die Kopfuerletzungen,' 1842, p. 57.) In a case read before the Anatomical

Society of Paris, an individual received a musket-shot in the left side of the thorax, and the ball remained lodged in the left lung during a period of *twenty-five years*. The ball, in penetrating, had fractured the humerus at its neck, in consequence of which the upper extremity had been amputated at the shoulder-joint. The wound of the chest soon healed, but the patient remained during life subject to fits of suffocation and hæmoptysis, under the effects of which he at length sank. On an examination of his body, the ball was found lying behind the third intercostal space in the midst of the pulmonary tissue, but lodged in a kind of cyst which communicated with the large air-tubes. Dr. Moore reports a case in which a person died fifty years after the receipt of a wound ('Lancet,' Jan. 16th, 1847). Alison quotes several cases in which persons have been found guilty of homicide—the injured persons having died from the indirect results of the wounds after the lapse of three and five months, and longer. ('Criminal Law,' p. 151.) In the case of Mr. Smith, who was shot by *Ross Touchet*, July 1844, death did not take place until after the lapse of eleven months from the time at which the wound was inflicted. In June 1839, a boy was admitted into Guy's Hospital for an injury to the spine, which proved fatal only after the lapse of eleven months. Among recent medico-legal cases, the *longest* interval at which a conviction has taken place from the indirectly fatal consequences, was *nine months*. It was in the case of *Reg.* v. *Valus*. (Devizes Summer Ass. 1847.) It was proved that the prisoner had maltreated the deceased in September 1846. After this she suffered in her health, and in December she was found labouring under *phthisis*. She died of the disease in the following May. Two medical men deposed that they found, on examining the body, that three ribs had been broken on the left side—and the injury had evidently not been attended to. They thought that the irritation caused by the fracture in September, might have led to the development of phthisis, although the seeds of the disease might have been long lurking in the system. The judge left it to the jury as a question depending on medical evidence, and they had to consider whether the consumption was caused, or the death of the deceased hastened, by the violence of the prisoner. They returned a verdict of guilty.

There is a singular rule in our law relative to the period at which a person dies from the wound—namely, that the assailant shall not be adjudged guilty of homicide, unless death takes place *within a year and a day* after the infliction of the wound. (Archbold, p. 345.) In practice, the existence of this rule is of little importance, but in principle it is erroneous. Most wounds leading to death generally destroy life within two or three months after their infliction: sometimes the person does not die for five or six months, and, in more rare instances, death does not ensue until after the lapse of twelve months, or even several years. These protracted cases occur especially in respect to injuries of the head and chest. Dr. Reid met with the following case:—A man was admitted into the Edinburgh Infirmary, labouring under vomiting and difficulty of breathing, with severe pain on the left side of his chest. He died in four hours, and on inspection it was found that part of the large intestines (colon) and the omentum had passed into the chest through an aperture in the diaphragm. There was a cicatrix in the muscle with which the intestine was incorporated showing that the injury was of very old date. The man had died from phrenic, or diaphragmatic hernia, and it turned out that he had received a wound about *fifteen months* previously, in the lower part of the left side of the chest, with a shoemaker's knife. This took place during a quarrel with a woman with whom he cohabited, but she was liberated on his apparent recovery. It seems that he had been attacked with severe pain in the abdomen (ileus), and had been in the infirmary on two different occasions subsequently to the wound, but had been dismissed each time apparently cured. ('Physiological Researches,' p. 523.) There was no doubt, although more than a year and a day had elapsed, that the stab was indirectly the cause of the man's death. In *Reg.* v. *Hynes* (Winchester Summer Assizes, 1860), it was proved that the prisoner had inflicted severe wounds on the head of deceased, and that death took place two months afterwards. The medical witnesses were perfectly agreed that death was caused by an abscess in the brain as a result of these wounds. The jury had great difficulty in finding a verdict of guilty, because in their opinion too long a time had elapsed for the injuries to have been the cause of death! But for the firmness of the judge, the prisoner would have escaped conviction, and would have owed that escape to the profound ignorance of the jury who tried him. Strict justice demands that the responsibility of a person who has inflicted a wound should depend upon its having really caused death, and not upon the precise period at which death takes place; for this must be a purely accidental circumstance.

Secondary causes of death.—A person who recovers from the immediate effect of a wound may die from fever, inflammation or its consequences, pyæmia, erysipelas, delirium tremens, tetanus, or gangrene; or an operation required during the treatment of a wound may prove fatal. These are what may be called secondary causes of death, or secondary consequences of a wound. The power of deciding on the responsibility of an accused person for an event which depends only in an indirect manner on an injury originally inflicted by him, rests of course with the authorities of the law. But it is impossible that they can decide so difficult and nice a question in the absence of satisfactory medical evidence; and on the other hand, it is right that a medical witness should understand the importance of the duty here required of him. *Fever* or *erysipelas* may follow many kinds of serious wounds, and in some few instances be distinctly traceable to them; but in others, the constitution of a person may be so broken up by dissipated habits as to render a wound fatal which in a healthy subject might have run through its course mildly, and have healed. When the fever or erysipelas can be traced to a wound, or there is no other apparent cause of aggravation to which either of these disordered states of the body can be attributed, they can scarcely be regarded by a medical practitioner as unexpected and unusual consequences, especially when the injury is extensive, and seated in certain parts of the body, as in the scalp. If death take place under these circumstances, the prisoner will be held as much responsible for the result as if the wound had proved directly mortal. This principle has been frequently admitted by our law, and, indeed, were it otherwise, many reckless offenders would escape, and many lives would be sacrificed with impunity. It is, however, difficult to lay down general rules upon a subject which is liable to vary in its relations in every case; but when a wound is not serious, and the secondary cause of death is evidently due to constitutional peculiarities from acquired habits of dissipation, the ends of justice are probably fully answered by an acquittal; in fact, such cases do not often pass beyond a coroner's inquest.

The secondary causes of death may be arranged under the following heads:—

1. *The cause is unavoidable.*—Of this kind are tetanus, following laceration of tendinous and nervous structures,—erysipelas following lacerated wounds of the scalp,—peritoneal inflammation following blows on the abdomen with or without rupture of the bladder or intestines, and effusion of their contents,—strangulation of the intestines (phrenic hernia), following rupture of the diaphragm, and others of a like nature. Here, supposing proper medical treatment and regimen to have been pursued, the secondary cause of death was unavoidable, and the fatal result certain.

2. *The cause avoidable by good medical treatment.*—There are, it is obvious, many kinds of wounds which, if properly treated in the first instance, may be healed and the patient recover, but when improperly treated they prove fatal. In the latter case, it will be a question for a witness to determine how far the treatment aggravated the effects of the violence, and from his answer to this, the jury may have to decide on the degree of criminality which attaches to a prisoner. Let us suppose, for instance, that an ignorant person has removed a clot of blood, which sealed up the extremity of a blood-vessel, in consequence of which fatal bleeding has ensued—or that he has caused death by unnecessarily interfering with a penetrating wound of the chest or abdomen—it would scarcely be just to hold the aggressor responsible, since, but for the gross ignorance and unskilfulness of his attendant, the wounded person might have recovered from the effects of the wound. When death is really traceable to the negligence or unskilfulness of a surgeon who is called to attend on a wounded person, this circumstance ought to be, and commonly is, admitted in mitigation, supposing that the wound was not originally of a mortal nature. Lord Hale observes:—'It is sufficient to constitute murder, that the party dies of the wound given by the prisoner, although the wound was not originally mortal, but became so in consequence of negligence or unskilful treatment; but it is otherwise where death arises not from the wound, but from unskilful applications or operations used for the purpose of curing it.' (1, 428.) The medical jurist will perceive that a very nice distinction is here drawn by this great judge, between death as it results from a wound rendered mortal by improper treatment, and death as it results from improper treatment, irrespective of the wound. In the majority of cases such a distinction could scarcely be established, except upon speculative grounds, and in no case, probably, would there be any accordance in the opinions of medical witnesses. In slight and unimportant wounds, it might not be difficult to distinguish the effects resulting from bad treatment from those connected with the wound, but there can be few cases of severe injury to the person, wherein a distinction of this nature could be safely made; and the probability is, that no conviction for murder would now take place, if the medical evidence showed that the injury was not originally mortal, but only became so by unskilful or improper treatment. In such a case, it would be impossible to ascribe death to the wound, or to its usual or probable consequences; and without this it is not easy to perceive on what principle an aggressor could be made responsible for the result.

3. *Comparative skill in treatment.*—If death has been caused by a wound, it signifies not that, under more favourable circumstances, and with *more skilful treatment*, a fatal result might have been averted. As an illustration, the following case, reported by Alison, may be quoted:—The prisoner was one of a party of smugglers who fired at an officer of excise. The wounded man was carried to the nearest village, where he was attended by a surgeon of the country, who was not deficient in attention. A great collection of matter formed in the leg, fever ensued, and the patient died at the end of three weeks. In defence, it was urged that, by *skilful* treatment, the man might have recovered; but the Court held that it was incumbent to prove that death arose *ex malo regimine.* The true distinction in all such cases is, that if the death was evidently occasioned by grossly erroneous medical treatment, the original author of the violence will not be answerable; but if it arise from the want merely of the higher skill which can be commanded only in great towns, he will be responsible, because he has wilfully exposed the deceased to a risk from which he had practically no means of escaping. ('Criminal Law of Scotland,' p. 150.) In the case of *Macewan* (Perth, Sept. Circ. 1830), the prisoner was indicted for the manslaughter of a boy, by

striking him a blow on the shoulder, which dislocated the arm. Two days after the blow, an ignorant bone-setter was consulted, and owing to his manipulations, inflammation took place, and the boy being of a sickly and scrofulous habit, this proved fatal. Under the direction of Lord Meadowbank the prisoner was acquitted. In charging the grand jury, in reference to Mr. *Seton's* case (Winchester Aut. Ass. 1845), Platt, B., is reported to have observed, that if a man inflict a wound likely to produce death, and the wounded party should fall into the hands of an unskilful practitioner, whereby death was hastened, the aggressor would still be responsible for the result. If the wound had not been likely to produce death, but by unskilful treatment death ensued, then that would not be murder. A case of this kind was tried at the Lewes Summer Assizes, 1858, *Reg.* v. *Kingshott.* A man in a quarrel received a bite on his thumb. He went to a quack, who applied some irritating ointment, which led to severe inflammation, and this rendered amputation of the arm necessary. He died from the effects of the operation. There was evidence that the original injury was slight, and would probably have healed but for the improper applications. On this evidence the prisoner was acquitted.

It will be obvious that a serious responsibility is thrown on practitioners who undertake the management of cases of criminal wounding. Any deviation from common practice should therefore be made with the greatest caution, since novelties in practice will, in the event of a fatal result, form one of the best grounds of defence in the hands of a prisoner's counsel. On these occasions every point connected with the surgical treatment will be the subject of rigorous inquiry and adverse professional criticism. In the case of a severe lacerated wound in the hand or foot followed by fatal tetanus, it may be said that the wounded person would not have died had amputation been at once performed. In this instance, however, a practitioner may justify himself by showing either that the injury was too slight to require amputation, or that the health or other circumstances connected with the deceased would not allow of its being performed with any reasonable hope of success. On the other hand, if the practitioner performed amputation, and the patient died, then it would be urged that the operation was premature, wholly unjustifiable, and that it had caused death. Here the surgeon is bound to show that the operation was necessary, according to the ordinary rules of practice. The treatment of severe incised wounds of the throat, when the windpipe is involved, sometimes places a practitioner in an embarrassing position. If the wound is left open, death may take place from bleeding; if it be prematurely closed, blood may be effused into the windpipe and cause death by suffocation.

The following case occurred a few years since in London:—A man inflicted a transverse wound on his throat; it was about four inches in length, and passed across the middle of the larynx. The bleeding was not considerable, as the carotid arteries had escaped being wounded. The external orifice had, in the first instance, been closed, and the patient was almost suffocated, partly by the occurrence of emphysema, and partly by the blood flowing into the windpipe. On opening the wound the patient's breathing was relieved, and a quantity of mucus mixed with blood was thrown out at each expiration. After waiting some time, the pieces of divided cartilage were brought together by sutures, and the wound carefully closed. In a short time the breathing became difficult, the countenance livid, and the man died apparently suffocated. Another case occurred in the neighbourhood of London, in June 1841. A woman was found in bed one morning with her throat severely cut, and a man was charged with the crime of murder. The wound had divided the windpipe and the superficial vessels. Although medical assistance was called in, it appears that nothing was done to arrest the bleeding for three quarters of an hour. The wound was then closed by ligatures, and the woman died immediately,—most probably from suffocation. The accused was tried and acquitted, because it appeared that this was an act of suicide. The first object of the surgeon, in all such cases, is to save life:—therefore the bleeding should be immediately arrested by securing the divided vessels. When this is done, the wound may be closed, but if the closure takes place before this, death from suffocation will commonly follow.

4. *The cause avoidable but for imprudence or neglect on the part of a wounded person.*—A man who has been severely wounded in a quarrel, may obstinately refuse medical assistance, or he may insist upon taking exercise, or using an improper diet, contrary to the advice of his medical attendant; or, by other imprudent practices, he may thwart the best conceived plans for his recovery. Let us take a common case as an illustration. A man receives a blow on the head in a pugilistic combat, from the first effects of which he recovers, but after having received surgical assistance, he indulges in excessive drinking, and dies. The aggressor is tried on a charge of manslaughter, and found guilty. Death under these circumstances is commonly attributed by the medical witness to effusion of blood on the brain; but it cannot be denied that the excitement produced by intoxicating liquors, will sometimes satisfactorily account for the fatal symptoms. In the case which we are here supposing, such an admission might be made, and the prisoner receive the benefit of it; for the imprudence or negligence of a wounded person ought not, morally speaking, to be considered as adding weight to the offence of the aggressor. If the symptoms were from the first unfavourable, or the wound likely to prove mortal, circumstances of this kind could not be received in mitigation. Our judges are at all times unwilling to admit them. In the case of the notorious *Governor Wall*, who was convicted and executed many years ago for causing the death of a man by excessive punishment, it was attempted to be shown in evidence that the deceased had destroyed himself by the immoderate use of spirits while under treatment in the hospital. The Lord Chief Baron, in charging the jury, observed that no man was authorized to place another in so perilous a predicament as to make the preservation of his life depend merely on his own prudence. The more clearly the medical witness is able to trace death to imprudence or excess on the part of the deceased, in the case of a *slight* wound, the more obviously would the responsibility of a prisoner be diminished; and hence the necessity for attending carefully to the progress of a wound, which, if it prove fatal, may involve another in a criminal charge. In the case of *Christian Paterson* (1823), referred to by Alison (p. 147), it appeared in evidence that the deceased was struck on the head with a smoothing-iron, which fractured her skull,—some days afterwards she drank a quantity of whisky, and was ultimately carried to the Royal Infirmary, where erysipelas shortly appeared in the wound, of which she died. Under these circumstances the charge of murder was abandoned, and the accused was found guilty of assault. The legal responsibility of the assailant is the same, whether the deceased die on the spot, or some days, weeks, or months afterwards, unless it can be distinctly proved that his death was immediately connected with the imprudence or excess of which he was guilty, and wholly independent of the wound. But, although a prisoner should be found guilty of manslaughter under these circumstances, the punishment is so adjusted by our law as to leave a considerable discretionary power in the hands of a judge. This is, indeed, tantamount to a direct legal provision, comprehending each different shade of guilt;—a man is held responsible for a wound rendered accidentally mortal, by events over which he could have no control, and which in themselves ought to be regarded as in some degree exculpatory. The punishment attached to his offence may be severe or slight, according

to the representation made by a medical witness of the circumstances which rendered the wound mortal; if he neglect to state the full influence of imprudence or excess on the part of the wounded person, where either has existed, over the progress of the wound, he may cause the prisoner to be punished with undue severity. The humanity of our judges is such, that when medical evidence is clear and consistent on a point of this nature, and there are no circumstances in aggravation, they commonly pass a mild sentence. (See case by M. Ollivier, 'Ann. d'Hyg.' 1842, p. 128.) The neglect to call in a medical practitioner, or the refusal to receive medical advice, will not, however, according to the decision in *Reg.* v. *Thomas* (Gloucester Aut. Ass., 1841), be considered a mitigatory circumstance in favour of the prisoner, even although the wound was susceptible of being cured. A man may receive a lacerated wound of a limb, which is followed by tetanus or gangrene, and thus proves fatal; he may have declined receiving medical advice, or have obstinately refused amputation, although proposed by his medical attendant. This would not operate as a mitigatory circumstance on the part of an assailant, because a wounded person is not compelled to call for medical assistance, or to submit to an operation, and a medical witness could not always be in a condition to swear that the operation would have positively saved his life; he can merely affirm that it might have afforded him a better chance of recovery. In the case of the *Queen* v. *Hulme* (Liverpool Aut. Assizes, 1843), it was proved that the deceased had died from tetanus caused by an injury to a finger some time before. Amputation was advised by the surgeon, but the deceased would not consent to the operation. The prisoner was convicted of manslaughter, and sentenced to the severest punishment prescribed by the law for that crime. In the case of *Mackenzie* (1827), the prisoner seized deceased by the throat, and bruised him severely in several parts of the body, in consequence of which tetanus supervened, and he died. Skilful medical advice was not called in until near the end of the illness, when tetanus had already come on, and in the interval deceased had acted imprudently and had aggravated the symptoms. The medical evidence clearly proved that the tetanus was owing to the injury, and was a frequent result of it. The prisoner, under the direction of the Court, was convicted, and subsequently transported. Again, a person may receive a blow on the head, producing fracture, with great depression of bone, and symptoms of compression of the brain: a surgeon may propose the operation of trephining to elevate the depressed bone, but the friends of the wounded man may not permit the operation to be performed. In such a case, his line of duty will be to state the facts to the Court, and it is probable that in the event of conviction there would be some mitigation of punishment; because such an injury, if left to itself, must in general prove mortal, and no doubt could exist, in the mind of any surgeon, as to the absolute necessity for the operation. But the neglect or improper conduct of a person who receives a wound thus rendered fatal, does not exculpate the aggressor. The crime is either murder or manslaughter.

5. *The cause avoidable but for an abnormal or unhealthy state of the body of the wounded person.*—Wounds which are comparatively slight sometimes prove indirectly fatal, owing to the person being in an unhealthy condition at the time of their infliction. In bad constitutions, compound fractures or slight wounds, which in a healthy person would have a favourable termination, are followed by gangrene, fever, or erysipelas, proving fatal. Here the responsibility of an assailant for the death may become reduced, so that, although found guilty of manslaughter, a mild punishment might be inflicted. The consequence may be, medically speaking, unusual or unexpected, and, but for circumstances wholly independent of the act of the accused, would not

have been likely to destroy life. In general, in the absence of malice, this appears to be the point to which the law closely looks, in order to make out the responsibility of the accused—namely, that the fatal secondary cause must be something not unusual or unexpected as a consequence of this particular injury. The medico-legal question presents itself under this form:—Would the same amount of injury have been likely to cause death in a person of ordinary health and vigour? Men who have suddenly changed their habits of living, and have passed from a full diet to abstemiousness, are sometimes unable to bear up against comparatively slight injuries, and often sink from the secondary consequences. So a man otherwise healthy labouring under rupture, may receive a blow on the groin, attended with laceration of the intestine, gangrene and death; another with a calculus in the kidney may be struck in the loins, and die, in consequence of the calculus perforating the blood-vessels and causing fatal bleeding, or subsequent inflammation. Mr. Crosse, of Norwich, has reported to the Medico-Chirurgical Society the case of a boy, aged ten, who received a slight blow on the abdomen, and died in an unexpected manner on the second day after the injury. On inspection, a cyst, capable of holding ten or twelve ounces of liquid, was found connected with the under surface of the liver. The cyst had been ruptured by the blow, and its contents had escaped into the abdomen. But for the cyst existing in this situation, the blow would not have been attended with dangerous consequences. In these cases, the effects of the violence must be regarded as something unexpected: it would not have produced serious mischief in an ordinarily healthy person, and hence the responsibility of an assailant becomes much diminished. The crime is undoubtedly manslaughter, but the punishment may be of a lenient description. A defence of this kind will, however, be limited by circumstances. A case is reported, in which a Dr. *Fabricius* was tried at the Old Bailey for the murder of his female servant by striking her a blow behind the ear, whereby a large abscess, situated at that part, was ruptured, and this ultimately caused her death. The chief question on the trial was, whether the deceased had died from the effects of the violence, or from the disease under which she was at that time labouring. The doctor ingeniously urged in his defence that he had struck the blow merely with the purpose of opening the abscess! The jury, however, did not agree in taking this professional view of the matter, and they found him guilty of manslaughter. In the case of the *Queen* against *Bell* and others (Nott. Autumn Assizes, 1841), it was proved that the deceased had died from the effects of a blow received in a prize-fight, which had ruptured an abscess in the kidney, evidently of long standing. The prisoners were convicted. In the case of *Bennett* v. *Gredley* (Exchequer Sittings, Hilary Term, 1854, which was a suit for compensation by reason of injuries inflicted on a boy's arm, it was argued in defence that the state of the arm was partly owing to a former injury; in reference to which the Chief Baron remarked, that a man was not bound to have his body in so sound and healthy a state as to warrant an unauthorized assault upon him. A man, therefore, who commits an unauthorized assault upon his fellow-man must take his chance of the effects which such an assault may produce. In the case of the *Queen* against *Wallis*, for murder (Cambridge Summer Assizes, 1864), the medical evidence showed that the deceased, an aged lady, had received several wounds and bruises on her face and head, and a severe contusion on the right side of her chest. There was a fracture of the ulna near the wrist, and she had lost much blood. After lying in danger for some days her condition improved, but she again got worse and died nineteen days after the infliction of the injuries. On inspection it was found that beneath the contusion of the chest, three ribs were broken but not displaced. There was disease of the valves of the heart of long standing, and it was proved that she had suffered from spasms in this region before the assault. The cause of death assigned by the witnesses was spasmodic seizure affecting the organs of the chest—principally the heart. The injuries which the deceased had received had lowered her system, and had rendered it less likely that she could recover from a spasmodic attack. In defence it was urged by the counsel for the prisoner, that if in any case the cause of death be partly traceable to injuries and partly to natural or other causes, a prisoner is entitled to an acquittal. In support of this view he quoted the case of *Johnson*, from Lewis's C. C., 1, p. 164. The objection was overruled by the judge (Channell, B.), who held that it was bad law in the face of recent decisions. There can be no doubt, that but for the injuries inflicted, the woman would not have died; therefore, the act of the prisoner was the moving cause of her death. In cases of a mixed character this is probably the best test to determine the share which the alleged violence, when not strictly of a mortal nature, had in the death of a wounded person. By adopting such a course as was taken on this occasion, the cause will be sufficiently defined for the guidance of a jury. As a rule, cases of this description are determined by the question—whether the violence, although not the immediate, was the accelerating cause of death.

It must be evident that there exist numerous internal diseases, such as aneurism, and various morbid affections of the heart and brain, which are liable to be rendered fatal by *slight* external violence. The law, as applied to these cases, is thus stated by Lord Hale:—'It is sufficient to prove that the death of a person was accelerated by the malicious act of the prisoner, although the former laboured under a mortal disease at the time of the act.' (1, 428.) In those cases in which a slight degree of violence has been followed by fatal consequences, it is for a jury to decide, under all the circumstances, upon the actual and specific intention of the prisoner at the time of the act which occasioned death. According to Starkie, 'it seems that in general, notwithstanding any facts which tend to excuse or alleviate the act of the prisoner, if it be proved that he was actuated by prepense and deliberate malice, and that the particular occasion and circumstances upon which he relies were sought for and taken advantage of merely with a view to qualify actual malice, in pursuance of a preconceived scheme of destruction, the offence will amount to murder.' In most of these cases there is an absence of intention to destroy life, but the nature of the wound, as well as the means by which it was inflicted, will often suffice to develope the intention of the prisoner. An accurate description of the injury if slight, may afford strong evidence in favour of the accused, since the law does not so much regard the means used by him to perpetrate the violence, as the actual intention to kill, or to do great bodily harm. Serious injury, causing death by secondary consequences, will admit of no exculpation when an assailant was aware, or ought to have been aware, of the condition of the person whom he struck. Thus, if a person notoriously ill, or a woman while pregnant, be maltreated, and death ensue from a secondary cause, the assailant will be held responsible; because he ought to have known that violence of any kind to persons so situated, must be attended with dangerous consequences. So, if the person maltreated be an infant or a decrepit old man, or one labouring under a mortal disease, it is notorious that a comparatively slight degree of violence will destroy life in these cases, and the prisoner would properly be held responsible. A wound which *accelerates* death *causes* death, and may therefore render the aggressor responsible for murder or manslaughter, according to the circumstances. The Commissioners appointed to define the criminal law on the subject of homicide thus express themselves:—'Art. 3. It is homicide, although the effect of the injury *be merely to accelerate the death* of one labouring under some previous injury or infirmity, or although, if timely remedies or skilful treatment had been applied, death might have been prevented.' This is conformable to the decisions of our judges. According to Lord Hale, if a man has a disease which in all likelihood would terminate his life in a short time, and another give him a wound or hurt which hastens his death, this is such a killing as constitutes murder. (Archbold, p. 345.) The case of *Regina* v. *Murton* (Maidstone Winter Assizes, 1862) presents many points of interest in reference to the medico-legal question of the acceleration of death by violence. There was no mortal wound, and the deceased was in an unhealthy state of body. Nevertheless the prisoner was convicted of manslaughter.

6. *Abnormal conditions.*—When an assailant could not have been aware of the existence of a diseased or an abnormal condition of parts in the wounded person, the question is somewhat different. In many persons the skull is preternaturally thin, and in most persons it is so in those places corresponding to the glandulæ Pacchioni. In a case of this kind a moderate blow on the head might cause fracture, accompanied by effusion of blood, depression of bone, or subsequent inflammation of the brain and its membranes, any of which causes might prove fatal. A trial involving this question occurred at the Norwich Summer Assizes in 1842. (*The Queen against Dowde.*) The prisoner, who was a policeman, was charged with manslaughter. The deceased, it appears, attempted to escape from the custody of the prisoner, and the latter, in endeavouring to prevent his escape, struck the deceased a blow on the head. The deceased spoke of the blow as trifling, and, with the exception of a slight headache, he made no complaint. On examining his head, there was a slight cut with a small effusion of blood. The deceased was placed in a cell, and some hours afterwards was found dead. On inspection, the skull was found fractured for an inch and a half over the seat of violence, and a quantity of blood had been effused and had caused death. The medical evidence on the trial was to the effect, that the blow did not appear to have been violent, that the skull of the deceased was preternaturally thin, not being more than one-twelfth of an inch in thickness at the fractured part. All agreed that a fracture might in this case have been caused by a blow, which, under ordinary circumstances, would have been attended with no serious mischief. In some persons, all the bones of the body are unusually *brittle*, so that they are fractured by the slightest force. Inflammation, gangrene, and death may follow, when no considerable violence has been used; but these being unexpected consequences, and depending on an abnormal condition of parts unknown to the prisoner, his responsibility may not, *cæteris paribus*, be so great as under other circumstances. This condition of the bones can be determined only by a medical practitioner. Facts of this kind show that the degree of violence used in an assault cannot always be measured by the effects, unless a careful examination of the injured part is previously made.

Some German medical jurists have contended that an unnatural transposition of parts should become a mitigating circumstance—as when, for example, the heart or some large vessel is not in its usual position, and is there wounded; but this doctrine will receive no sanction from an English Court of law, as the responsibility of persons for these criminal offences does not rest upon the perfect anatomical structure of the deceased! At the same time, it might become a question whether, if death occurred from a superficial wound, whereby a large artery taking an abnormal course, was divided—there might not be, *cæteris paribus*, some ground for diminishing the degree of responsibility.

7. *Difficulty of proof in death from secondary causes.*—When a person is

charged with having caused the death of another through violence terminating in some fatal disease, the case often admits of a skilful defence, and this in proportion to the length of time after the violence, at which the deceased dies. The disease, it may be urged, is liable to appear in all persons, even the most healthy; or it may arise from causes unconnected with the violence. In admitting these points, it must be remembered that death may be proved to have been indirectly a consequence of the wound by the facts: 1, that the supervention of the secondary cause, although not a common event, lay in the natural course of things; 2, that there did not exist any accidental circumstances which were likely to have given rise to this secondary cause independently of the wound. The proof of the first point amounts to nothing, unless the evidence on the second point is conclusive.

CHAPTER 41.

WOUNDS INDIRECTLY FATAL. TETANUS FOLLOWING WOUNDS—ERYSIPELAS—DELIRIUM TREMENS—GANGRENE—DEATH FROM SURGICAL OPERATIONS—PRIMARY AND SECONDARY CAUSES OF DEATH—UNSKILFULNESS IN OPERATIONS—NECESSITY FOR AN OPERATION—PYÆMIA FOLLOWING ACCIDENTS OR OPERATIONS.

Tetanus following wounds.—This disease frequently presents itself as a secondary fatal consequence of wounds, especially of those which are lacerated or contused, and affect nervous or tendinous structures. It has often occurred as a result of slight bruises or lacerations, when the injury was so superficial as to excite no alarm; and it is a disease which gives no warning of its appearance. Dr. Brady met with a case in which a man slipped in walking, and fell flat on his back. He was stunned, but able to walk home. He apparently recovered from this simple accident, but on the following day he was attacked with tetanus, and died in seventy hours. ('Lancet,' May 15, 1847, 516.) In the case of *Reg.* v. *Butcher* (Warwick Lent Assizes, 1848), it was proved by medical evidence that the deceased had received a blow on the nose, which caused severe bleeding. In spite of good surgical treatment, the man was attacked with tetanus on the fifteenth day, under which he sank. On inspection, it was found that one of the small bones of the nose had been broken, and this had given rise to the fatal attack. Tetanus may come on spontaneously, *i.e.*, independently of the existence of any wound on the body. Cases have been brought into the London hospitals, in which the only cause of this disease appeared to be exposure to cold or wet, or, in some instances, exposure to a current of air. ('Lancet,' Dec. 14, 1844, 351.) Dr. Watson met with an instance in which tetanus appeared in a severe form in a man who had received no wound, but who had been simply exposed to cold and wet. (Cormack's 'Monthly Journal,' Dec. 1845, 902.) It has sometimes come on without any apparent cause. It is scarcely possible to distinguish, by the symptoms, tetanus from wounds (traumatic) from that which occurs spontaneously as a result of natural causes (idiopathic). In endeavouring to connect its appearance with a particular wound or personal injury, it will be proper to observe—1, whether there were any symptoms indicative of it before the maltreatment; 2, whether any probable cause could have intervened to produce it, between the time of its appearance and the time at which the violence was inflicted; 3, whether the deceased ever rallied from the effects of the violence. The time at which tetanus usually makes its appearance, when it is the result of a wound, is from about the third to the sixth day; but it may not appear until three or four weeks after the injury, and the exciting cause may still be traced to the wound which may have healed. When resulting from a wound it is generally fatal.

A medical practitioner is bound to exercise great caution before he pronounces an opinion that a fatal attack of tetanus has arisen either from spontaneous causes or from slight blows or personal injuries. A case occurred in St. Bartholomew's Hospital, in September 1853, which exemplifies the necessity of making a rigorous inquiry into all the attendant circumstances. A boy, æt. 15, while quarrelling with another, received a blow in the back from his companion's fist, and this was followed by a kick, but not of a severe character. He was able to get up and walk home; in about two hours he complained of stiffness of the lower jaw. He passed a restless night—the stiffness increased; there was great pain, and subsequently difficulty in swallowing. On the second day he was admitted into the hospital,—the pain and stiffness gradually increased, and the jaw became partially fixed. Spasm of the muscles of the back supervened, occurring in paroxysms, and there was confirmed tetanus. He died on the fourth day after he had received the blow on the back, and apparently from tetanus as a result of that violence. It turned out, however, on inquiry, that six days previously to the first appearance of the tetanic symptoms, the boy had accidentally driven a rusty nail into his foot, and that the suppurating wound which resulted from this injury had only closed on the day on which the blow was inflicted. On an examination of the body a small puckered cicatrix, such as would result from the healing of a punctured wound, was found on the ball of the great toe, and there could be no doubt from the circumstances, that this, and not the slight blows struck by the assailant, had been the cause of the fatal attack of tetanus. ('Lancet,' Dec. 10, 1853, p. 550.) This case has an important bearing on the question considered at p. 475. It is probable that many cases have been set down as idiopathic tetanus in which, by proper inquiry, the disease might have been traced to a wound or some personal injury. In one instance the tetanus was at first considered to be idiopathic: but shortly before death a small black mark was observed on the thumb-nail. On making inquiry, it was found that a few days previously to the attack a splinter of wood had accidentally penetrated the thumb. The patient attached so little importance to the accident that he did not mention the circumstance to his medical attendant. This was no doubt the cause of the disease.

Many trials for wounding have occurred in this country in which tetanus was the immediate cause of death; and the defence has generally rested upon the probable origin of the disease from accidental causes. Among these, that of Capt. *Moir*, who was tried at the Chelmsford Assizes in 1830 for the murder of a fisherman, is one of the most interesting, as it developes the rule of law in respect to criminal responsibility, when death takes place from a secondary cause. The deceased had frequently trespassed on the grounds of the prisoner, but, notwithstanding warnings which he had received, he set the prisoner at defiance. On the day laid in the indictment, the prisoner, while riding, met the deceased crossing his grounds, in order to pursue his usual occupation of fishing. An angry altercation took place, and the deceased refused to return. The prisoner, in a high state of irritation, then rode back to his house, which was at some distance from the spot, and, having procured his pistols, rode after the deceased, and overtook him in the act of continuing the trespass. Words again ensued between them, and the prisoner then fired at deceased and wounded him severely in the arm. The muscles, vessels, and nerves were extensively lacerated, but no question seems to have been raised respecting the propriety of immediate amputation. The deceased lingered a short time: tetanus supervened, from which he died. On the trial, at the Chelmsford Assizes, the medical evidence went to show that death was caused by tetanus, brought on by the severe gun-shot wound inflicted by the prisoner. In his defence, it was alleged that he shot the deceased under provocation, and that he had not intended to kill him, for he had purposely aimed at the arm. With regard to the first point, it was considered that the fact of his returning to his house, to fetch a weapon capable of inflicting a mortal wound, was evidence of deliberate malice; while, with regard to the second point, there could be no extenuation, since a serious wound inflicted on an extremity, may destroy life as readily as a wound inflicted on the trunk. The prisoner was found guilty and executed, but his execution was considered by many to be *summum jus.* In this case, the connection of the secondary cause of death with the original wound appeared to be so clear, that not a doubt existed in the minds of the professional witnesses; and the law held the prisoner to be as much responsible for the fatal result as if he had killed the deceased on the spot.

Erysipelas, like tetanus, may be a fatal result of slight injuries. Wounds affecting the scalp are liable to be followed by this disease. Burns and scalds sometimes prove fatal through this secondary cause. Some constitutions are particularly prone to erysipelatous inflammation, and thus, wounds, comparatively slight, may have a fatal termination. In *Reg.* v. *Littlewood*, for manslaughter (York Summer Assizes, 1858), it was proved that deceased had died from erysipelas consequent on a burn which he had received from an explosion of gas. The cause of death was clearly proved, but the evidence failed to show criminal negligence, and the prisoner was acquitted.

On these occasions, in order to make an assailant responsible for the fatal result, the erysipelas must be clearly traced to the injury. The medical facts that the person assaulted has never recovered from the effects of the violence, and that the inflammation set up has suddenly assumed an erysipelatous character, are sufficient to establish this connection. If there has been recovery, and an interval of some days has elapsed, a doubt may arise respecting the connection of the erysipelas with the violence inflicted. This disease is occasionally idiopathic, *i.e.*, it appears like tetanus without any assignable cause. In the following case, which was the subject of a trial at the Central Criminal Court in July 1859, the erysipelas did not show itself until thirteen days after the injury, and it proved fatal on the seventeenth day.

A potman, stated to be of temperate habits, was struck on the left cheek with a quart pot. There was a contusion, but no injury to the skin. The man was slightly stunned by the blow, but was able, in less than an hour, to prefer a charge against the aggressor. From this time he did not appear to suffer any ill effects from the blow, and continued as usual at his work for a period of thirteen days after the receipt of the injury, when erysipelas of the ordinary character made its appearance. It commenced on the bridge of the nose and both eyes. Towards the close of the same day the man had an attack of delirium tremens; the erysipelas began to assume an unhealthy aspect on the sixteenth day, and he was then brought to St. Thomas's Hospital. The erysipelas was now general over the face and head, and delirium tremens was strongly marked. Death took place on the following afternoon, and at the post-mortem examination twenty hours after death, only slight congestion of the brain was found. At the coroner's inquest, on the medical witness (Mr. Clayton) being called, he was asked whether it was probable (as far as was currently known), that erysipelas could supervene upon a contused wound *thirteen days* after a blow. His reply was in the negative, and he expressed an opinion that the erysipelas could not be attributed to the blow. Hence the death of the man did not result indirectly from the blow, as was sought to be proved. The coroner, however, and the jury disregarded the medical evidence and committed the man for trial. At the trial the same medical evidence of the cause of death having been given, the Recorder immediately directed the jury to acquit the prisoner, stating that there was no evidence to prove that the death had been in any way caused or hastened by the injury inflicted.

Dr. John Reid ('Physiological Researches,' p. 512) has pointed out a singular appearance in death from erysipelas which, unless the facts had been known, might have given rise to a serious mistake. A man died from erysipelas in the left leg. On uncovering the body twenty-four hours afterwards, for the purpose of inspection, it was observed that the skin over the fore and middle part of the leg affected with the erysipelas had assumed a dark purple colour, resembling so strongly the appearance of ecchymosed blood consequent upon injury, that all who were present confessed that if they had not been aware of the previous history of the case, the appearance might have been attributed to some injury received during life. When, however, the apparently ecchymosed part had been cut into, it was found that no blood had been effused into the cellular tissue, but the skin was increased in thickness, and its vessels were loaded with dark blood.

It is sometimes difficult to establish the connection of *erysipelas* with a wound, especially when the disease occurs in a remote part of the body, not implicated in the wound. When this cannot be distinctly made out, there will be an acquittal. The following case was tried before the Justiciary Court at Glasgow, in 1822. A gamekeeper to Lord Blantyre was indicted for the murder of a poacher, whom he shot so severely in the left arm, that it was found necessary to perform amputation above the elbow. The man died of erysipelas in the right leg; and the question on the trial was, whether the erysipelas was brought on by the gun-shot wound or not. Upon this question there was great difference of opinion among the medical witnesses. One gave it as his opinion, that the debility caused by the wound brought on the disease of which the deceased died. Another thought that the tendency to erysipelas had existed long before the man received the wound. It appeared in evidence, that the deceased had been out for two nights in the exercise of his vocation, and had slept without shelter,—that during this time he had eaten but little, and above all, that he had an ulcer in his leg, the absorption of matter from which, in the opinion of some of the witnesses, had laid the foundation of the disease before the injury was received. 'Under all these circumstances,' observes the reporter, 'what would have been the best mode of treatment in such a case, supposing the deceased had received no wound at all?' 'Undoubtedly,' he continues, 'the very treatment which he did receive in consequence of it—copious bleeding, light diet, and perfect rest: while the counter-irritation from the amputation, so far from increasing the inflammation which was going on in the groin, must have acted like a blister or a seton in repressing and counteracting it!' The jury seem to have agreed in this view of the case, for the prisoner was acquitted of the charge. (Beck's 'Med. Jurisprudence, Wounds.') Taking the circumstances as they are above reported, it certainly did not appear that the erysipelas was directly connected with the wound, and unless this had been clearly and satisfactorily proved, it would have been unjust to make the prisoner responsible for the fatal consequences. The bad habit of body and the actual existence of disease in the leg, were facts in themselves sufficient to render such an opinion improbable. But in addition to this, it is stated by Alison, that erysipelas was at the time prevalent in the Glasgow Infirmary, and that deceased was put into a bed formerly occupied by a patient labouring under this disorder. Until then, the wound had presented no peculiarly dangerous symptoms.

Delirium tremens is a disease which frequently presents itself as a secondary consequence of injuries to persons of intemperate habits. The injury may be slight or severe, this disease will equally supervene and prove fatal. It is observed occasionally as a consequence of operations required for the treatment of wounded persons. The remarks made at p. 485 upon the influence of unhealthy constitutions on wounds, apply with especial force to cases of this description.

In the case of *Reg.* v. *Heywood* (C.C.C. Oct. 29, 1846), it was proved that the deceased had been assaulted by the prisoner, but had not sustained any personal injury likely to be followed by serious consequences. Nevertheless, symptoms of delirium tremens came on, and he died in the course of a few days. It was alleged that the disease of which the deceased died was brought on by the violence, and the evidence of Mr. Coulson was adduced in support of this view. This gentleman deposed that he was called upon to attend the deceased on the day after the assault; his face was swollen and black, particularly on the right side, and there were two wounds on that side of the face. He did what was necessary at the time, and the next day the wounds were nearly healed. The deceased appeared to suffer from great tremulousness and weakness, and these constitutional symptoms continued to increase, although the wounds were rapidly healing, and the swelling had nearly subsided. Two days before his death the ordinary symptoms of delirium tremens came on, and of this he died. In Mr. Coulson's opinion death was attributable to a shock of the nervous system, causing delirium tremens; and he accounted for that shock by the attack made upon the deceased, and by the blows he had received. On a post-mortem examition he could not discover any fracture of the skull or of the bones of the face, or a rupture of any blood-vessel. The right lung was much congested, and there were some old adhesions to the chest. The left lung was also congested. The heart was large and flabby, but he did not discover anything in the appearance of the body to account for death, except delirium tremens. He considered that this arose from the attack made on the deceased, but he was certainly surprised to see so fatal a result from such slight injuries. By the Court.—He considered the blows the deceased had received were the exciting cause of delirium tremens. It was generally the result of violent injury, but he had known it follow from slight blows. By prisoner's counsel.—He should say, from the appearances he observed on the post-mortem examination, that the deceased was a 'bad subject.' The injuries the deceased had received were certainly not sufficient to account for the death of a healthy man. The shock to the system might have been produced by the deceased's excited condition, and delirium tremens might be occasioned by excitement alone. The skull of the deceased was remarkably thin, and if there had been any great violence, he should have expected to find the bones fractured. Excitement might produce delirium tremens, but, as there had been blows in this case, he thought it more natural to ascribe it to them than to mere excitement. If the system had not been in a bad state, the result would not have been so serious, but he considered the blows to have been the exciting cause of death. The judge asked if he was right in understanding the witness to allude to the moral effect of the blows, to the excitement they occasioned on the system, rather than to the actual result that might reasonably be expected from injuries of such a character. Mr. Coulson said that that was what he intended to convey by his statement. By prisoner's counsel.—He would not undertake to say that the deceased would not have died from the excitement alone, even if he had not received any blows. On re-examination, he said that the blows and the excitement together were, no doubt, the cause of death. A second medical witness said, that in his opinion the deceased's death was the result of his excited state, and that delirium tremens was thereby occasioned, and not by the blows he received. He described the liver and kidneys of the deceased, as exhibiting the appearance of those of a person addicted to drinking spirits or beer. It was contended that there was no distinct proof of the actual cause of death, or that the disease of which the deceased died had been brought on by the wounds, and the prisoner was acquitted of the felony. ('Med. Gaz.,' 38, p. 811.)

Death from surgical operations.—In the treatment of wounds, surgical operations are frequently resorted to, and a wounded person may die either during the performance of an operation, or from its consequences. A question may thence arise, whether the person who inflicted the wound shall be held responsible for the fatal result. The law regards a surgical operation as part of the treatment, and if undertaken *bonâ fide*, and performed with reasonable care and skill, the aggressor will be held responsible, whatever may be the result. The necessity for the operation, and the mode of performing it, will be left to the operator's judgment. As the defence may turn upon the operation having been performed unnecessarily, and in a bungling and unskilful manner, it will be right for a practitioner, if possible, to defer it until he has had the advice and assistance of other practitioners. According to Lord Hale, if death takes place from an *unskilful operation*, performed for the cure of a wound, and not from the wound, the responsibility of the prisoner ceases; but this eminent lawyer does not appear to have considered that death may take place as a consequence of the most skilful operation required for the treatment of a wound, and yet be wholly independent of the wound itself.

Death is by no means an unusual result of severe operations, the secondary consequences under which the patient may die being very numerous even when the case is most skilfully managed. Sometimes the patient will die on the table, although but little blood may have been lost:—In a case related by Dr. Evans, of Galway, the patient, a healthy man, who had sustained a severe injury by an accident, died in a few moments after his leg had been amputated, although he had not lost more than four ounces of blood. Fear, pain, and sudden shock to the nervous system, have caused death under these circumstances. The most common indirect causes of death after severe operations, are secondary hæmorrhage, erysipelas, tetanus, delirium tremens, pyæmia, and hectic fever with gangrene of the stump. Mr. Travers observes, that, 'a pre-existing disease of the liver, kidney, or testicles, though chronic, and in itself not alarming to the constitution, becomes a drag upon its elasticity, and stands in the way of recovery. Inspection of the body after death, frequently explains the unfavourable result of operations that promise well, by discovering one or more organs in a state of chronic disease, which had not previously deranged the health in a degree sufficient to give notice of its existence; and which might, therefore, have remained quiet for years to come, had no extraordinary call been made upon the powers of the system.' ('On Constitutional Irritation,' p. 45, 121, et seq.)

Should an operation be unnecessarily or unskilfully performed, the responsibility of an aggressor would, it is presumed, cease, if the death of a wounded party could be clearly traced to it. Thus, if in carelessly bleeding a wounded person, the brachial artery should be laid open ('Ann. d'Hyg.,' 1834, t. 2, p. 445), or if, in performing amputation, a large artery be improperly secured, so that the patient in either case dies from loss of blood, the prisoner could not be equitably held responsible; because it would be punishing him for an event depending on the unskilfulness of a medical practitioner. According to Platt, B. (p. 331), a prisoner will be held responsible, if the original wound were likely to produce death, although unskilfully treated. Supposing the bleeding or amputation to be performed with ordinary care and skill—and yet, in the one case inflammation of the veins, and in the other erysipelas, tetanus, gangrene, or fever should destroy life, the prisoner will be liable for the consequences. The practice of the law is strictly consistent with justice. Should the operation be considered to be *absolutely* required for the treatment of a wound, which, according to all probability, would prove mortal without it,—should it be performed with ordinary skill, and still death ensue as a direct or indirect consequence, it is only just that the person who inflicted the injury should be held responsible for the result. It is presumed in these cases, that were the patient left to himself, he would, in all probability, die from the effects of the wound. If, therefore, a surgeon, knowing that an operation would give a chance of saving life on such an occasion, did not perform it, it might be contended in the defence, that the deceased had died, not from the wound, but from the incompetency and neglect of his medical attendant. Hence it follows that if, during this necessary treatment, unforeseen though not unusual causes cut short life, no exculpation should be admitted, if it went to attack the best-directed efforts made for the preservation of life. (See 'Ann. d'Hyg.' 1835, t. 1, p. 231.)

In a large number of operations it is now the general practice among surgeons to administer *chloroform vapour*, not only to allay pain but to prevent the exhaustion to the patient, likely to arise from protracted surgical proceedings. In spite of care on the part of the operator, this vapour is liable to destroy life in an unexpected manner, and the patient may die either before the operation is commenced or during its performance. The facts may leave no doubt that the wounded person died from chloroform, and not from the wound or the operation. On inspection of the body, the heart may be found in an unhealthy state, a fact which is usually considered sufficient to account for the fatal effects of chloroform vapour. In a case of this kind—What becomes of the responsibility of the person who inflicted the original wound? No decision, so far as I know, has ever been given on this point. Was the use of chloroform vapour in a professional view a *necessary* part of the treatment? Was it skilfully and *properly* administered? Could the diseased condition of the heart which rendered the effects of the vapour more fatal than usual have been detected by the operator, so as to show the impropriety of administering it in this case? These questions should receive satisfactory answers before the aggressor is rendered responsible for death under such peculiar circumstances.

If an operation is rendered necessary for maltreatment of an injury, the responsibility of an assailant for a fatal result ceases. In *Reg.* v. *Kingshott* (Lewes Summer Assizes, 1858), it was proved that prisoner and deceased fought, and that the prisoner bit the deceased severely on the thumb. According to the medical evidence the wound would, in all probability, have healed of itself, or with some slight applications, but it seemed that the deceased went to a corn-leech in the neighbourhood, who had the reputation of performing wonderful cures, and he applied a powerful salve to the wound, the consequence of which was that severe inflammation ensued. The deceased then applied to a regular practitioner, who did all that was possible under the circumstances, but the whole arm was in such a condition that it was deemed advisable to remove him to the hospital, where his arm was amputated, and he died from the effects of the operation. For the defence it was contended that the prisoner ought not to be convicted of causing the death of the deceased, inasmuch as it was proved that the original injury was of a slight character, and not at all calculated to produce a fatal result, and that the deceased had conduced to his own death by suffering himself to be treated by an ignorant and unskilful person. The learned judge held that the charge of manslaughter could not be supported upon the evidence, and he therefore directed the jury to acquit the prisoner.

By an operation being *absolutely required*, are we to understand that it is necessary to preserve life, *i.e.*, that the wound will probably prove fatal without it? Bleeding and cupping may be necessary as part of the treatment of a wounded person; but unless it could be sworn that this treatment was required, in the judgment of the surgeon, for the *preservation of life* from the injury inflicted, it is doubtful whether, in the event of death occurring from these simple operations, the assailant would be held responsible for the fatal result. In 1827, two persons were tried in Edinburgh, for capitally assaulting another, by throwing sulphuric acid over him. (*Rex* v. *Macmillan.*) The death of the deceased was clearly due to inflammation of a vein and concomitant fever, following the operation of bleeding, which was considered necessary in the treatment of the case. It did not appear that this bleeding was absolutely necessary for the preservation of life, but merely for the prevention of severe ophthalmia. The charge of murder was therefore abandoned by the Lord Advocate: this question of responsibility for the fatal result being considered to involve too nice a point to ensure conviction. ('Ed. Med. and Surg. Jour.' April 1829, 230.)

From cases hitherto decided, it would appear that the law regards three circumstances in death following surgical operations:—1st, the necessity of the operation itself; 2d, the competency of the operator; and 3d, the fact that the wound would be likely to prove mortal without it. A few recent cases will serve to illustrate the view taken by our judges of this most important question, which may involve, not merely the reputation of a surgeon, but the life of an accused party. The first which requires notice is that of the *King* against *Quain* and others (Limerick Spring Assizes, 1836.) Dillon (the deceased) received a comminuted fracture of the leg, produced by blows with a stick. He was taken to an hospital, and it was proposed to amputate the injured leg, but deceased would not consent. After some days, symptoms of approaching mortification made their appearance. All the surgeons agreed that the only chance of saving life, was the immediate removal of the leg. The deceased then gave his assent, and the operation was skilfully performed. The injury was inflicted on the 10th October; the operation was not performed until the 9th of November, and Dillon died on the 19th (*i. e.* ten days after the operation) from tetanus, which, it was admitted, had resulted from the amputation, and not from the wounds inflicted by the prisoners. For the prisoners it was argued that the deceased did not die of the wounds as alleged in the indictment, but from the medical treatment. On the other side, it was contended that the injury to the leg was *causa causans*, as the recovery of the patient would have been utterly hopeless without amputation, and the counsel properly asked, 'Is he (a wounded person) to lose the benefit of medical skill, lest death might ensue from a necessary although dangerous operation? How unfair would such a course be to the accused, as well as unjustifiable towards the wounded person! If neglected, his death is certain; if subjected to the treatment, his recovery probable.' The learned judge held (the amputation being considered a necessary part of the patient's treatment) that the death of Dillon, although not proximately, was actually caused by fracture of the leg, and so directed the jury, who returned a verdict of guilty. The disputed point was reserved, and argued before the twelve judges. In addition to the arguments in support of the conviction above given, it was represented as being laid down in the books, that if one give a wound to another, who neglects the cure, or is disorderly, and doth not keep that rule which a wounded man should do, yet if he die it is murder or manslaughter; because if the wounds had not been given the man had not died. (See case *Reg.* v. *Thomas*, *ante*, p. 484.) The exceptional cases are where death results from the medical treatment; but these are reducible to two classes:—1. When the wound is *not* in itself *mortal*, and the treatment causes the death. (*Rex* v. *Macmillan*, p. 495.) And 2ndly, when the death is clearly caused by the *treatment*, either by reason of its being *unskilful*, or not being necessary to save life in the opinion of skilful persons. (*Rex* v. *Macewan*, *ante*, p. 481.) The judges ruled the point against the prisoner with the exception of one dissentient.

In this case, the three conditions requisite for responsibility clearly existed: the operation was absolutely necessary to save life—there could be no question as to the competency of the operator—and the wound would, according to all surgical experience, have proved fatal without it.

On a more recent occasion (*Reg.* v. *Perrall*, Taunton Lent Assizes, 1847), Cresswell J. gave a similar judgment. The prisoner had thrown a stone at the deceased, and caused a fracture of the skull. On a consultation, the medical practitioner performed the operation of trephining. The deceased apparently rallied, but he subsequently became worse, and died on the 19th day after the injury; and it was found that there was an abscess in the brain. The medical witnesses referred death to the blow, but admitted that it might have been accelerated by the operation. It was contended in the defence, that although the injury without the operation might have proved mortal, yet that the deceased had died from the medical treatment. Cresswell J. observed, that it was admitted the wound was mortal, and that the deceased might have died in a month, but that he had died in less than a week in consequence of the operation. The wound being mortal, if that which was done by the surgeon was what he considered right to be adopted, there would be no question raised upon this point. The prisoners were convicted. In this case, there can be no doubt as to the propriety of the decision. Competency for forming a judgment, or for undertaking an operation, does not imply, on these occasions, the first-rate abilities of a surgeon of high standing, but that average skill and experience which every legally qualified practitioner is presumed by law to possess; and although from numerous extraordinary recoveries, it is difficult to say whether a man would or would not have died under a particular injury without an operation, yet here, again, the law would allow a free exercise of judgment, and would not act upon extraordinary exceptions.

In a similar case, which occurred a few years since in Germany, an attempt was actually made to exculpate the aggressor on the ground that he had died owing to the medical man having neglected to perform the operation of trephining, and that he would have recovered had this been resorted to! ('Brit. and For. Med. Rev.' 13, 259.)

Operations under a mistaken opinion.—It may happen that the wound is not mortal, and that, although skilfully performed, the operation was *not* necessary to save life: in other words, the wounded person may die from the immediate results of a serious operation, performed under a mistaken view of the case. It is well known to surgeons that a cancerous tumour has been occasionally mistaken for aneurism, an artery has been secured, and death has followed. A case occurred in Dublin in 1844, in which the carotid artery was tied,—and another in London in 1845, in which the operation was performed on the common iliac artery for supposed aneurisms: in both of these instances, the patients sank, and after death the tumours were proved not to have been aneurismal. The operations proved fatal, and were not necessary; they had been performed by mistake. A more recent instance is reported by Mr. Syme. The carotid artery was tied, and the patient died in a few days from loss of blood. After death it was found that the tumour was not an aneurism but a cyst containing a thin fluid. (‘Dub. Med. Press,’ Dec. 22, 1847, p. 302.) Let us take the case that a man labouring under a slight aneurismal dilatation of a large artery receives a blow on the part,—the tumour gradually increases, and is mistaken for an abscess by three or four surgeons, whose professional standing would prevent their general competency from being questioned. Under a wrong diagnosis, it is opened, and the patient dies on the spot: it would, in such a case, be unjust to make the aggressor liable; for, even admitting that the aneurism resulted from the blow, and that competent surgeons acted with *bona fides*, the treatment would be unskilful, and the case would fall under the rule laid down by Lord Hale (*ante*, p. 481). The real facts, however, may not transpire until after the death of the wounded person; and it may then be alleged by a prisoner's counsel, that the operation was not necessary to save life, and that the wounded man might have recovered without it. This question derives especial interest from the Gosport duel case (June 1845), in which a Lieutenant *Seton* was killed. (*Reg.* v. *Pym*, Hants Lent Assizes, 1846.) A tumour formed in the course of the pistol-shot wound received by the deceased at the lower part of the abdomen; and this was supposed by the late Mr. Liston, and two other surgeons in attendance on the deceased, to be an aneurismal enlargement from a wound in or injury to the femoral artery, for which it was considered necessary to tie the external iliac artery. The patient died from peritoneal inflammation following this serious operation; and on inspection, it was found that the tumour (the supposed aneurism) was formed by a mass of coagulated blood poured out, not from the femoral artery, but from one of its superficial and anomalous branches, which was divided about an inch below Poupart's ligament, and an inch from the main body of the artery. There was some difference of opinion about the necessity for the operation, both as to the time selected for its performance, and as to its being absolutely requisite for the preservation of life. One witness thought that it was absolutely necessary to perform it at the time: while another thought it absolutely necessary, under the circumstances, to save life. In his evidence at the trial, Mr. Liston stated, that ‘the tying of the iliac artery was necessary. The danger of allowing the false aneurism to go on would be violent bleeding, which might have proved instantly fatal. In my judgment no other operation would have been prudent than that of tying the iliac artery.’ Counsel for the prisoners proposed to cross-examine the medical witnesses in order to show that the wound was not dangerous to life, and the operation not absolutely necessary; but Erle J. interposed.—I presume you propose to call counter-evidence, and impeach the propriety of the operation, but I am clearly of opinion that if a dangerous wound is given, and the best advice is taken, and an operation is performed under that advice, which is the *immediate* cause of death, the party giving the wound is criminally responsible. Cockburn.—I propose to show that the opinion formed by the medical men was grounded upon erroneous premises, and that no operation was necessary at all, or, at least, that an easier and much less dangerous operation might and ought to have been adopted. I may therefore cross-examine the witnesses as to the grounds of their opinion. I shall submit that a person is not criminally responsible where the death is caused by consequences which are not physically the consequences of the wound, but can only be connected with the first wound by moral reasonings, as here that which occasioned death was the operation, which supervened upon the wound because the medical men thought it necessary. The point has never been solemnly decided in this country. The cause of death is a question for the jury. Erle J.—I am clearly of opinion, and so is my brother Rolfe, that where a wound is given, which, in the treatment of competent medical advisers, is dangerous, and the treatment which they *bonâ fide* adopt is the immediate cause of death, the party who inflicted the wound is criminally responsible, and of course those who aided and abetted him in it. I so rule on the present occasion; but it may be taken, for the purposes of future consideration, that it having been proved that there was a gun-shot wound, and a pulsating tumour arising therefrom, which, in the *bonâ fide* opinion of competent medical men, was dangerous to life, and that they considered a certain operation necessary, which was skilfully performed, and was the immediate and proximate cause of death,—the counsel for the prisoner tendered evidence to show this opinion was wrong, and that the wound would not inevitably have caused death, and that by other treatment the operation might have been avoided, and was therefore unnecessary. I will reserve this point for the consideration of the judges, although, as I have already stated, I have no doubt upon the subject. To admit this evidence, would be to raise a collateral issue in every case as to the degree of skill which the medical men possessed.

The point was reserved, but as the prisoner was acquitted of the charge, the opinion of the judges was not taken. ('Law Times,' March 21, 1846, p. 500.) The question was subsequently raised at the trial of the principal in the duel *Reg.* v. *Hawkey*, Hants Summer Ass., 1846), but Platt B. decided in accordance with the opinion of Erle J. and Rolfe B. The prisoner was acquitted. ('Law Times,' July 25, 1846, p. 370.) Although in this case no question could arise as to the competency of the surgeons, or the skill with which the operation was performed, yet the principle involved in the decision, stops all inquiry respecting the necessity of an operation, leaving this to the *bonâ fide* judgment of the operator,—and it leaves undecided, as in *Macmillan's* case (*ante*, p. 495) the important question whether the operation was or was not necessary to save life. Such a rule, if rigorously carried out, would undoubtedly shelter many surgical mistakes; and although in this instance the best advice was taken, yet as the degree of skill in the operator is not an ingredient in the prisoner's responsibility (*ante*, p. 496), the decision could hardly be justified upon this ground. Had the operation been performed by the usual attendant of the deceased, it is to be presumed that the result would have been the same; hence it appears, that although an operation might be unnecessarily performed and cause death, yet the prisoner would be held responsible for the result. A man has his leg fractured by a blow; a surgeon, acting on a *bonâ fide* opinion of danger to life, may amputate the leg; the wounded person dies from a sloughing of the stump, or some other secondary cause; and an investigation of the facts may show that amputation was not necessary, and that the patient might have recovered without it. Is the person who inflicts the blow to be made responsible for the mistake? Is no inquiry to be instituted respecting the propriety or necessity of an operation always dangerous to life? It is obviously impossible that anything can be known to the Court extra-judicially, respecting competency, necessity, or skill in operating on these occasions, until all the facts have been laid before the jury. But to take what may appear to be a nearer parallel to *Seton's* case:—A man during a quarrel receives a severe blow in the groin from his adversary; this is followed by a pulsating tumour, which is pronounced to be an aneurism of the femoral artery by three competent surgeons out of five (two dissentient), and the dangerous operation of tying the external iliac artery is performed. The patient dies in about thirty-six hours from peritonitis, as a direct result of the operation; and after death, it is found that the tumour was not an aneurism, and had no connection with the femoral artery,—that the tying of the artery was not really required in the opinion of competent surgeons, and that had the case been left to itself, the patient might have recovered. Is the person who struck the blow to be made responsible for the fatal result? Upon the ruling in *Pym's* case, he would be, for provided the operation was performed with *bona fides*, the question as to necessity could not be raised. The relative degree of skill possessed by medical men does not, therefore, become a question for a jury in a criminal case; although in civil cases, as in actions for malapraxis, the whole of the medical facts are invariably submitted to their judgment. This difference can only be justified by the assumption, that a man who inflicts a wound must take all the consequences—good or bad. No operation would have been required, but for the injury, and the prisoner ought not to escape on account of want of skill in a surgeon, or of a mistake made by a skilful operator. It was decided in the cases of *Rex* v. *Quain* and *Reg.* v. *Pym*, that although the indictment alleged that the prisoner died of the wound, while in fact he died from the results of an operation, yet it was good in point of law. The case of *Thouret Noroy* shows that the French law also acts upon this principle. This gentleman, who was a physician, performed the operation of bleeding on a patient. It is alleged, but upon evidence of a very questionable character, that he punctured the brachial artery in opening the vein. Three months afterwards, the patient applied to another practitioner, an officier de santé, one of the lowest grade in France, who declared that an aneurismal tumour existed at the spot where the man was bled. He advised tying the brachial artery, and he subsequently performed the operation; but mortification of the limb ensued, and the patient was afterwards compelled to undergo amputation. As he was a labouring man, the loss of his arm was so serious, that he was advised by his friends to seek reparation in damages from the physician who first bled him. The trial came on in a Provincial Court, and heavy damages were awarded against the physician. An appeal was made to a Superior Court, but the sentence was confirmed and the damages were increased. Of this case it may be fairly said, *summum jus summa injuria*. Admitting that the defendant had been guilty of gross carelessness and criminal inattention in puncturing the brachial artery, there was fair ground to question whether the subsequent operation of tying the artery was a necessary or proper mode of treatment under the circumstances. There is no doubt that the officier de santé acted with *bona fides*, and took this view; but it seems to have been a case demanding an inquiry into the circumstances which led him to operate; for the operation may have been unnecessary and unjustifiable on the principles of good surgery. It is highly probable that the patient sustained a greater amount of damage at the hands of the surgeon who tied the artery, than of the physician who punctured it.

When a wounded person is taken to a hospital in which gangrene or erysipelas is diffusing itself by infectious propagation, and he is attacked by one of these diseases before or after the performance of an operation, and dies, a prisoner may be held responsible for the fatal result. It might be contended that the transportation of the wounded man to such a locality was not absolutely necessary to the preservation of his life, and that he would not then have died, but for the accidental presence of an infectious disease. Cases of this kind cannot be easily determined by general rules, but the question has already been raised before a legal tribunal, in a trial which took place at the Maidstone Lent Assizes, 1839. (*The Queen* against *Connel and others.*) The deceased was assaulted by a number of soldiers, and received two blows on his head with a stick. The wound was not of any great extent, and the deceased did not appear to suffer much from it. Two days afterwards, he was attacked by *erysipelas* in the head and face, and he died in about a week. On inspection, there was no appearance of disease. The surgeon referred death to erysipelas, which was prevalent in the hospital at the time the deceased was brought in. The man would probably have recovered but for the attack of erysipelas, and he did not think that he would have been attacked by that disease but for the wound. Erysipelas was an infectious disease, and a common consequence of wounds of the head. Upon this evidence the prisoners were convicted. In *Reg.* v. *Norris* (Wells Summer Assizes, 1860), the deceased, a gamekeeper, died from tetanus following amputation of the leg, rendered necessary by a gun-shot wound inflicted by the prisoner. No attempt was made to deny the responsibility of the prisoner for the fatal result (see p. 491).

In addition to erysipelas and tetanus, there is another cause of death which is liable to follow personal injuries and operations, namely *pyæmia*, or the introduction of pus into the blood by absorption or by the mouths of divided blood-vessels. The purulent matter appears to act as a poison, and one of its marked effects is to coagulate the blood either in the large vessels or in the capillaries. According to Dr. Wilks' observations, pyæmia is seldom observed after superficial injuries during the process of healing, or after wounds resulting from simple operations, but it occurs frequently when a bone is involved either in the injury or as a result of an operation. Inflammation of the cellular membrane surrounding bone is a condition highly favourable to its occurrence. It has been stated that the cause of death in one half of the cases of amputation is pyæmia. (See a paper on this subject by Dr. Wilks, 'Guy's Hospital Reports,' 1861, p. 119.) In *Reg.* v. *Maynard* (Maidstone Lent Assizes, 1862) involving a charge of manslaughter by wounding, the medical evidence was to the effect that death was caused by pyæmia. Extensive suppuration had taken place, abscesses had formed in the cellular membrane, and pus had been absorbed to a degree to prove fatal. The medical witness must remember that pyæmia may arise from causes totally irrespective of wounds or personal injuries. (Cases by Dr. Habershon, 'Guy's Hospital Reports,' 1859, p. 179.)

Questions relative to responsibility in death following operations would come more frequently before Courts of law, were it not that the cases are stopped in the Coroners' courts by verdicts of accidental death. (See 'Med. Gaz.' vol. 19, p. 157.) It unfortunately happens that on these occasions there is great difference of opinion among medical witnesses respecting the connection of the disease with the death, and, indeed, the necessity for the operation itself. The evidence of opinion in favour of the prosecution is sometimes exactly balanced by that urged in the defence, and under these circumstances, the only course open to the Court is to direct an acquittal. Differences of opinion upon these subjects among members of the profession tend to convey to the public the impression that there are no fixed principles upon which medical opinions are based, and, consequently, that it would be dangerous to act upon them. Thus it is that we are accustomed to hear of a medical prosecution and a medical defence, as if the whole duty of a medical jurist consisted in his making the best of a case, on the side for which he happens to be engaged,—adopting the legal rule for suppressing those points which are against him, and giving an undue prominence to others which may be in his favour. This is an unfortunate condition of things, for which at present there appears to be no other remedy than that of appointing a Medical Board of competent persons, to act as assessors, to whom such questions should be referred, in the same manner as questions relative to navigation are referred by the Admiralty Court to a Board formed of members of the Trinity House, —professionally acquainted with the matters in dispute.

Medical Responsibility in Operations. Malapraxis.—This is a very wide subject, but it can here be only glanced at in a few of its leading features. It was held by Lord Ellenborough, that if a person acting in a medical capacity be guilty of misconduct arising either from gross ignorance or criminal inattention, by which a patient dies, he is guilty of manslaughter. Faults, such as omissions, or errors in judgment, to which all are liable, are not visited with this amount of criminality. The same rule applies to the licensed as to the unlicensed practitioner; but it would appear, from the charge of Williams J. (Winchester Spring Ass. 1847), that a degree of unskilfulness which might lead to the conviction of a licensed, would justify the acquittal of an unlicensed person. This was in the case of a midwife, aged 72, alleged to have caused the death of a woman on whom she had been called to attend. 'The charge,' said the learned judge, 'appeared to be, that by want of skill or attention to her duties, she had caused the death of the woman upon whom she was attending. In order to constitute this offence, it must be shown that the party was guilty of criminal misconduct, either arising from gross ignorance, or want of skill, or gross inattention. With respect to the degree of want of skill, he must say, that it was not to be expected that a midwife who was called in to attend a person in the humble class of the deceased, a soldier's wife, should exhibit what a regular medical practitioner would call competent skill. It was enough if she applied that humble skill which, in ordinary cases, would lead to a safe delivery. She was not bound to have skill sufficient to meet peculiar and extraordinary exigencies, although in the case of a regular medical man, such skill might be required. The class of this humble practitioner was absolutely necessary for the poorer classes, and, although on the one hand it was fit the law should protect the patient by punishment for gross want of skill, yet he thought there would be much to be lamented if it was applied with such severity as to render a party not possessing skill of this kind liable to punishment for manslaughter.'

Charges of manslaughter have frequently been brought against medical practitioners in cases of midwifery. In some instances gross mismanagement has been proved; the uterus, and even parts of the viscera, have been torn away, and in such cases convictions have very properly followed. It is well known, however, that much difference of opinion exists among the most eminent practitioners of midwifery respecting the treatment to be pursued in certain cases of difficulty, as where the after-birth presents (placenta prævia). There are eminent accoucheurs who advise in this case entirely opposite modes of practice, and who look upon that pursued by the other as of the most dangerous kind. The case of *Reg.* v. *Dickinson* (Stafford Lent Assizes, 1846) is in this respect of interest. A medical practitioner was charged with having caused the death of the deceased in her confinement. This appears to have been a case of placenta prævia: the placenta was removed, but the female sank under the bleeding which followed. Platt B., after consulting several medical works, charged the jury that if, in a particular case, there are two modes of treatment respecting the adoption of either of which men of learning are equally divided, then no man can be said to be 'grossly ignorant' in adopting a course which has received the approbation of eminent writers, and which his own judgment sanctions and approves. The accused was immediately acquitted. ('Med. Gaz.,' vol. 37, p. 875.)

When death is not a result of the medical treatment, an action for damages may be brought against the practitioner for *malapraxis*. From the evidence given on some of these occasions, it appears that an action of this kind is occasionally resorted to as a very convenient way of settling a long account.

It has been a question whether slight deviations from the ordinary mode of performing operations should involve a practitioner in a charge of malapraxis. I am not aware that this question has been raised in England; but a remarkable instance occurred in the United States a few years since, in which an action was brought and damages were recovered against a medical man for alleged negligence in vaccinating a young female (case of *H. L. Landon*). Some inflammation of the skin followed the operation, which, it was alleged, was performed nearer to the elbow-joint than was usual. The plaintiff soon recovered from the effects. The most singular feature of this case was the ruling of the judge: he said—'In performing the operation of vaccination or inoculation, the physician is liable for all consequences if he neglects the usual precautions, or fails to insert the virus in that part of the arm *usually selected* for the purpose; notwithstanding many other parts of the body might be proved to be equally proper and even more suitable locations!' If this be law, it is a very singular specimen of transatlantic jurisprudence. It might as well be ruled that a limb should always be taken off with a particular kind of knife, and the bone sawn through with a *normal* saw; and in case of neglect of this rule, that the operator should be made responsible for the result!

The case of *Gibbs* v. *Tunaley*, tried at the Norfolk Lent Assizes, 1845, is interesting in relation to this subject. An action was brought against the defendant, a surgeon, for alleged negligence and want of skill in treating an injury to the foot, which the plaintiff had sustained. Mortification took place, and amputation was necessarily performed. The plaintiff and his witnesses alleged that the mortification was caused by tight bandaging, but the defendant brought good medical evidence to show that it was most probably due to the extensive violence from the accident (a railway accident), and there is but little doubt that this was the correct view of the case. Mr. Baron Parke observed in his charge, that they (the jury) were not to expect from a country practitioner the same amount of eminent skill to be met with in large towns: but they had a right to expect from him the usual and ordinary amount of skill, care, and attention which it was only reasonable to suppose he would possess: and if, in the discharge of his duty, he applied his professional skill and knowledge to the best of his ability, then, however unfortunate the termination of the case, he was not to be visited with an action to mulct him for damages. Such a step would be most unjust, and have an injurious tendency, as it would check that independence of action so necessary for medical men to possess. Damages one farthing!

In the case of *Baker* v. *Lowe* (Queen's Bench, Feb. 1845), a medical man brought an action against the defendant for the amount of his bill, and the defence was that he had been unskilfully and improperly treated. The defendant had been attacked with senile gangrene in the toe; the toe was removed, but the disease involved the foot, and amputation was again performed. The plaintiff had adopted a stimulating plan of treatment in the first instance, which it was alleged was improper. The medical evidence was very conflicting, and the only inference which can be deduced from it is, that in some cases a stimulating, and in others an antiphlogistic treatment is admissible. The plaintiff brought two experienced witnesses who approved of his treatment, and the jury returned a verdict for the greater part of the amount claimed. (See 'Med. Gaz.,' vol. 36, p. 126.) When there is such a division of opinion among men of equal experience, a practitioner has a right to expect that a verdict will be returned in his favour; since it is not to be supposed that in order to recover payment for a bill, or to answer a charge of unskilfulness, a man's practice should receive the unanimous approval of the *whole* of his professional brethren, especially in cases in which there is an acknowledged difference of opinion respecting the treatment. On this showing, a man would never be able to recover his charges for the treatment of a case of severe burn or scald; since some practitioners consider it malapraxis to adopt the stimulating, while others equally regard it as malapraxis to adopt the cooling plan of treatment! All that appears to be expected is a reasonable accordance in treatment with received professional doctrines.

CHAPTER 42.

CICATRIZATION OF WOUNDS — EVIDENCE FROM CICATRICES—CHANGES IN AN INCISED WOUND—IS A CICATRIX ALWAYS A CONSEQUENCE OF A WOUND?—ARE CICATRICES, WHEN ONCE FORMED, INDELIBLE? — CHARACTERS OF CICATRICES — MEDICAL EVIDENCE RESPECTING THE PERIOD AT WHICH A WOUND WAS INFLICTED — GANGRENE AND PUTREFACTION — CHANGES IN CONTUSIONS—HOW LONG DID THE DECEASED SURVIVE THE WOUND?

Cicatrization of wounds. — The period of time at which a particular wound was inflicted, may become a medico-legal question, both in relation to the living and the dead. The identity of a person, and the correctness of a statement made by an accused party, may be sometimes determined by an examination of a wound or its cicatrix. So, if a dead body be found with marks of violence upon it, and evidence adduced that the deceased was maltreated at some particular period before his death, it will be necessary for a practitioner to state whether, from the appearance of the injuries, they could or could not have been inflicted at or about the time assigned. A case was tried at the Taunton Spring Assizes, 1841 (*The Queen* against *Raynon*), wherein evidence of this kind served to disprove the statement made by the accused. He was charged with maliciously cutting and wounding the prosecutrix. There was a cut upon his thumb, which he accounted for by saying it was from an accident that had occurred three weeks before. The medical witness declared, on examining it, that it could not have been done more than two or three days, which brought the period of its infliction to about the time of the murderous assault. This with other circumstances led to his conviction.

An *incised* wound inflicted on the living body gradually heals by adhesion, when no circumstances interfere to prevent the union of the edges. For eight or ten hours the edges remain bloody,—they then begin to swell, showing the access of inflammation. If the parts are not kept well in contact, a secretion of a serous liquid is poured out for about thirty-six or forty-eight hours. On the third day this secretion acquires a purulent character. On the fourth and fifth days, suppuration is fully established, and it lasts five, six, or eight days. A fibrous layer, which is at first soft and easily broken down, then makes its appearance between the edges: this causes them gradually to unite, and thus is produced what is termed a *cicatrix*. Cicatrization is complete about the twelfth or fifteenth day if the wound is simple, of little depth and width, and only affecting parts endowed with great vitality. The length of time required for these changes to ensue will depend—1. On the situation of the wound;—wounds on the legs are longer in healing than those on the upper part of the body. If a wound is situated near a joint, so that the edges are continually separated by the motion of the parts, cicatrization is retarded. 2. On the extent; a deep or wide wound is long in undergoing cicatrization. Wounds involving many and different structures are also longer in healing than those simply affecting skin and muscles. 3. On the age and health of the wounded person; the process of cicatrization is slow in old persons as well as in those who are diseased and infirm. In an incised wound the cicatrix is generally straight and regular; but it is semilunar if the cut is oblique. It is soft, red, and tender if cicatrization is recent: it is hard, white, and firm if of long standing. On compressing the skin around an old cicatrix, its situation and form are well marked by the blood not readily entering into it on removing the pressure. It has been said that the cicatrices of incised wounds are rectilinear, but this is not always the case; in general, they are more or less elliptical, being wider in the centre than at the two ends,—this appears to be due principally to the elasticity of the skin and the convexity of the subjacent parts; thus it is well known that in every wound on the living body the edges are more separated in the centre than at the ends, and this physical condition influences the process of cicatrization. When the wound is in a hollow surface, or over a part where the skin is not stretched, as in the armpit or groin, then the cicatrix may be rectilinear, or of equal width throughout. If there were any loss of substance in an incised wound, or if the wound were lacerated or contused, the cicatrix would be irregular, and the healing would proceed by granulation. The process might then occupy five, six, or eight weeks, according to circumstances. When healed, the cicatrix would be white, and if there had been a loss of substance it would have a puckered appearance; the surface of the skin would be uneven. (See an essay on this subject by Dr. Krugelstein, Henke's 'Zeitschrift der S. A.' 1844, b. 2. s. 75.)

Is a cicatrix always a consequence of a wound?— Assuming that the term wound implies a breach of continuity affecting the layers of the true skin, a cicatrix is always produced in the process of healing. In an even cut made by a very sharp instrument, especially if it is in the direction of the fibres of subjacent muscles and the parts are kept in close apposition, the cicatrix is even, linear, and sometimes so small as to be scarcely perceptible. If the skin is white, it may be easily overlooked. Wounds of this kind are not, however, commonly the subject of medico-legal inquiry. If, on examining a part, where at some previous time a stab or a cut is alleged to have been inflicted, we find no mark or cicatrix, it is fair to assume that the allegation is false, and that no wound has been inflicted, making due allowance for the fact that mere abrasions of the cuticle, or very slight punctures and incisions, often heal without leaving any well-marked cicatrices.

Is a cicatrix, when once formed, ever removed or so altered by time as to be no longer recognizable?—This is a question which sometimes presents itself to a medical jurist both in civil and criminal proceedings. They who have given close attention to the subject agree in considering that cicatrices, when they are once so produced in the cutis or true skin as to be easily perceptible, are indelible:—they undergo no sensible alteration in their form or other external characters. The tissue of which a cicatrix is formed, is different from that of the skin; it is harder, and contains less blood, and is destitute of a coloured deposit (rete mucosum), so that its whiteness, which is remarkable on the cicatrized skin of a negro, is retained through life. If any cicatrices were easily obliterated, it would be those which are even and regular,—the results of incised wounds by sharp instruments; but I have observed that cicatrices of this kind have certainly retained their characters unchanged in one instance for twenty, and in another for twenty-five years. According to the observations of Dupuytren and Delpech, the substance of a cicatrix is not converted into true skin—it never acquires a rete mucosum, *i.e.* the membrane which gives colour to the skin. Although this is generally true of incised and punctured wounds, yet contused and lacerated wounds on the legs of persons advanced in life frequently present a brown discolouration—from the deposit of a brown pigment. In the cicatrices of lacerated and contused wounds, the form of the weapon with which the wound was inflicted is sometimes indicated. It is not, however, easy to distinguish the cicatrix of a stab from that produced by a pistol-bullet fired from a distance. In both cases the edges may be rounded and irregular, and the cicatrix puckered, unless the stab has been produced by a broad-bladed weapon. If no mark of cutting can be perceived within a few months of the period at which a severe wound is alleged to have been inflicted, it is reasonable to infer that there has been some mistake, or that the circumstances have been greatly exaggerated.

A case in which this question was raised, was referred to me under the following circumstances. (The *Queen* against *Henry Reed* and *Elizabeth Donelan*, Chelmsford Spring Assizes, 1842.) The medical evidence was to the effect, that 'there was a wound on the nose of the prosecutrix, apparently inflicted by some sharp instrument, and the bridge of the nose was broken down. The weapon had entered half an inch, and had caused profuse bleeding. The wound was sufficiently deep, that if it had entered a little higher up in the eye, it might have caused death.' In the defence it was urged that no weapon had been used; and that although the male prisoner had struck the prosecutrix a blow, the female prisoner had taken no share in the assault. It does not appear that any medical evidence was called to show in what state the prosecutrix was, at the time of the trial. It was assumed that a weapon must have been used, and the prisoners were convicted, the one of stabbing and the other of aiding and abetting. About six months after the alleged stabbing, and some weeks after the prisoners had been convicted and sentenced to punishment, the face of the prosecutrix was examined by two surgeons (one of them a practitioner of twenty-eight years' standing), and they both deposed that there was no mark of a cicatrix, of fracture of the nose, or of any personal injury whatever. Other surgeons were requested to examine the face of the prosecutrix, but this she declined permitting; and as there was no power to compel her, the medical facts of the case were referred to Professor Quain, Mr. Guthrie, Mr. Key, and myself. The evidence of the surgeon at the trial was laid before us with the statements of the two surgeons, who subsequently examined the prosecutrix. We all agreed that if such a wound as that described in the medical evidence had been inflicted, there would have been a visible scar and a ridge or prominence indicative of the situation where the bridge of the nose was stated to have been broken down: and as no such marks could be perceived by two well-informed surgeons, we considered it improbable either that such a wound as that described could have been inflicted, or that a weapon could have been used in the assault. The question really to be decided was—Could all traces of such a wound as that above described be effaced in a period of six months, or even during the life of a person? Either the wound must have been misdescribed, or some traces of it would unquestionably have been found.

Characters of cicatrices.—It is important to observe that all cicatrices are of smaller size than the original wound; for there is a contraction of the skin during the process of healing. This is especially observed with regard to the cicatrix of a *stab*, which is frequently of a triangular form. A recent stab, owing to the elasticity of the skin, is smaller than the weapon; and the resulting cicatrix is always smaller than the wound. Hence it is difficult to judge of the size of the stabbing instrument from an examination of a cicatrix. In gun-shot wounds, if the projectile has been fired from a distance, the cicatrix is of smaller diameter than the ball: it represents a disk depressed in the centre, and attached to the parts beneath; while the skin is in a state of tension from the centre to the circumference. If the bullet has been fired near to the body, the cicatrix is large, deep, and very irregular. If the projectile has made two apertures, the aperture of exit is known by the greater size and irregularity of the cicatrix. (See 'Ed. Monthly Journal,' 1854, vol. 10, p. 370.) As the age of a cicatrix increases, it becomes smaller, thicker, more shining, fainter in colour and less sensitive.

Cicatrices from disease or wounds.—In certain cases a question may arise whether the cicatrix on a person has resulted from a wound or from loss of substance through disease, *e.g.* scrofulous ulceration. In the case of *Smyth* v. *Smyth* (Gloucester Summer Assizes, 1853), the plaintiff claimed to be the rightful heir to certain estates occupied by the defendants. He based his claim upon some deeds (alleged by the defendants to have been forged), in which it was stated that the lost heir to these estates would be known by certain marks on his right hand and wrist, suggested to have been received at the time of his birth, in 1797, by reason of his having been brought into the world by instruments. It was one of the curious features of this extraordinary case of imposture that no medical opinion was taken or required by the claimant on the probable nature and origin of these marks. When requested at the trial to show his hand to the jury, the mark had the appearance of a puckered cicatrix from a scrofulous ulcer near the wrist. Similar marks from scrofulous sores were seen upon his neck. His statements regarding himself, and the circumstances on which he based his claim, were so improbable and contradictory, that the case speedily broke down. A question of this kind may occasionally present some difficulty, but a close examination of the cicatrix, with a consideration of the statement of the person as to its mode of production, will generally enable a practitioner to arrive at a satisfactory conclusion respecting its origin. *Scrofulous* ulcers are generally observed to leave irregular and furrowed cicatrices, with smooth depressions, surrounded by hard and uneven margins. According to Schneider, the *scorbutic* cicatrix is dark, bluish-red in colour, soft to the touch, somewhat raised and rather painful: in the course of time it becomes flatter, of a reddish-brown colour, approaching to green (?) in the centre, and very thin and easily injured. *Syphilitic* cicatrices are characterized by great loss of substance: they approximate the margins of the deep ulcers before their granulations have had time to reach the surface. *Glandular* cicatrices are irregularly tumefied, generally deep, hardened, and of a reddish-brown colour. These varieties cannot easily be mistaken for the cicatrices of wounds.

When was the wound inflicted?—When a person is not seen until after death, and there are recent wounds on his body, a medical jurist may be required to state at what period they were probably inflicted. It may be taken as a general rule that there are no appreciable changes in any wound until eight, ten, or twelve hours have elapsed from the time of its infliction; then we have the various changes indicative of inflammation, followed by adhesion, suppuration, or gangrene, during any of which stages the wounded person may die. Some remarks have already been made on the time at which adhesion and suppuration are established in wounds; and with respect to gangrene it may be observed, that the deceased must have survived at least fifty hours, in order that this process should be set up: in old persons it may take place earlier.

The occurrence of gangrene in a living person is so well marked from the condition of the parts injured, that a medical opinion may be formed without difficulty. The case is different, however, when a practitioner is called upon to examine a dead body in which putrefaction has commenced, for, under these circumstances, parts which are merely putrefied may be pronounced to be gangrenous. Parts which are the seat of severe injury at the time of death, undergo putrefaction more rapidly than those which are unaffected by the accident. In April 1859, Mr. Denton, a former pupil, consulted me in reference to a case, in which a man narrowly escaped a committal on a charge of manslaughter, apparently from the effects of ordinary putrefaction in a wounded limb having been mistaken for gangrene. A truck loaded with coal was driven over the knee of a boy. A bone-setter was called in, and the case was left in his hands by a surgeon, who saw the boy at the same time. The boy died from an attack of pneumonia six days after receiving the injury. There was no evidence of maltreatment, and no appearance of gangrene in or about the limb, while the boy was living. It was supposed that the bone-setter had caused the boy's death, and after an interment of three days, the body was exhumed and examined by a surgeon who had not seen the deceased while living. Ignoring the observations of those who had seen and examined the knee-joint of deceased, as well as the fact that wounded parts putrefy rapidly, and that five days had, in this instance, elapsed since death, the inspector came to the conclusion, that deceased had died from mortification, as a result of bad treatment. A proper examination of the facts, however, satisfied the jury that the alleged gangrene was only the natural state of putrescence in the injured limb. The bone-setter was thus exculpated.

When a body has undergone putrefaction generally, the effects of gangrene in a wound may be merged in the changes caused by this process, and great care should be used in assigning these changes to one or the other condition. Gangrene implies the death of a part in the living body, and putrefactive changes take place in the dead part, as in the entire dead body. If changes resembling those of gangrene are found in a wounded limb while the rest of the body is not in a putrescent state, there may be some reason for the opinion that there was gangrene during life. In this case, however, due allowance should be made for the more rapid decomposition of wounded parts. The best evidence will be that which shows the condition of the injured part in the living body. If putrefaction is advanced, the opinion of a person who has not seen the deceased while living, can be little more than a conjecture.

The time at which a severe *contusion* has been produced may be commonly determined by noting the changes of colour which take place around it. It is rarely until after the lapse of twenty-four or thirty-six hours that these changes of colour appear. (See Ecchymosis, *ante*, p. 388.) The livid circumference passes into a green circle, which is gradually diffused into a wide straw-yellow band, bounding the ecchymosis on every side, if it be in a free or loose part of the skin. In four, five, or six days, the dark livid colour slowly disappears from the circumference to the centre, while the coloured bands spread more widely around. A central dark spot may be perceived after ten days or a fortnight, and in an extensive ecchymosis it is some weeks before all traces of colour are lost. The rapidity of these changes will be modified by circumstances elsewhere stated. Observations of this kind often lead to useful results when proper caution has been taken. The appearances presented by a contusion inflicted recently before death, and of another inflicted some days before, are of course different; and by an appreciation of this difference, a person charged with murder may or may not be connected with one or the other period of infliction, or with both. In a case of alleged manslaughter, in which I was consulted some years since, there were found on the person of the deceased, the wife of a mechanic, the marks of severe bruises; some of them, in the immediate neighbourhood of each other, had the rings of colour peculiar to a disappearing ecchymosis, while others had not. The man alleged in his defence that he had only struck his wife once, a few hours before her death, whereas the above medical facts proved not only that the deceased had been struck more than once, but that some of the blows must have been inflicted probably several days before her death. These inferences were corroborated by the evidence of an apprentice who had witnessed the assaults.

Such is an outline of the facts which may occasionally enable us to say how long before death particular injuries have been received; or to assign a probable period for their infliction on the living. By their aid we may have it in our power to determine whether two wounds found on a dead body were or were not inflicted at or about the same time. The law in these cases seldom requires a precise medical opinion; indeed, it would be scarcely possible to give this under any circumstances. If a medical witness can only state *about* what time the injury was inflicted, circumstantial evidence will make up for the want of great medical precision or accuracy on the point.

How long did the wounded person survive?—This question, it will be perceived, is indirectly connected with the preceding, although sometimes put with an entirely different object. Supposing the wound not to have been such as to prove rapidly fatal, the length of time which a person has survived its infliction may be determined by noting whether it has undergone any changes towards healing, and in what degree. As a wound remains in the same state for about eight or ten hours after its production, it is not possible to say within this period how long the person may have survived. Then it has been supposed that a medical opinion might be formed from the nature of the injury, and the parts which it has involved. Thus, a wound may have involved large blood-vessels, or organs important to life: in this case it is pretty certain that the wounded person must have died speedily. Let us, however, bear in mind that these so-pronounced rapidly mortal wounds sometimes do not prove fatal until after the lapse of some hours or days—a fact which has been much overlooked by surgeons, although of considerable importance in relation to the medical jurisprudence of wounds.

CHAPTER 43.

ACTS INDICATIVE OF VOLITION AND LOCOMOTION—INJURIES TO THE HEAD NOT IMMEDIATELY FATAL—WOUNDS OF THE HEART NOT IMMEDIATELY FATAL—WOUNDS OF THE CAROTID ARTERIES—LOCOMOTION AFTER RUPTURES OF THE DIAPHRAGM AND BLADDER—SUMMARY.

Acts indicative of volition and locomotion.—In cases of death from wounds criminally inflicted, it is often a matter of serious inquiry, whether a person could have performed certain actions, or have moved after receiving an injury which is commonly regarded as necessarily mortal, and likely to destroy life speedily. In respect to wounds of a less grave description, if we except those affecting the limbs directly, which will be hereafter examined, the power of willing and moving in the person who has received them cannot be disputed. The best way of treating this subject will be, perhaps, to select a few cases of severe injuries to important parts or organs, which are usually considered to destroy life speedily. The question relative to the power of exercising volition and locomotion has been chiefly confined to those cases in which there were injuries to the head, wounds of the heart, the large blood-vessels, the diaphragm, and bladder.

Cases have been frequently brought into Guy's Hospital, where a patient who had received a blow on the head, has survived several hours or days; and after death, such injury to the cranium has been found as would, if the person had been seen only when dead, have probably given rise to a medical opinion that he must have died instantly. On the other hand, a person may fall lifeless from a blow which would produce no appreciable physical changes in the cranium or its contents; yet in this case, if the facts had been unknown, it would have been said the person might have survived some hours or days. Thus, then, we see that it is by no means easy to determine, from an examination of a wound in a dead body, how long the person actually lived after its infliction. By this remark it must not be understood that an opinion on this subject is never to be expressed from the nature and extent of an injury, but what should be impressed upon a medical jurist is, that it must not be hastily given; for a groundless suspicion of murder may be thereby excited against some innocent person. A wound may be mortal, but it by no means follows that it should have destroyed life instantaneously. As an illustration of the evil results of the practice of giving these hasty medical opinions, I may take a case which, to my knowledge, has occurred twice under almost similar circumstances. A man is found dead in his chamber with his throat cut, and the incision is proved to involve one or both carotid arteries. The medical inference is that he must have fallen dead on the spot, and that he could not have survived an instant. If this be true, the weapon ought, of course, to be found either in the hand of the deceased or close to his body; but it is lying in another room, and there are marks of blood between the two rooms. What, then, is the conclusion? Either that the medical opinion is erroneous, and the deceased could not have dropped down dead *instantly;* or that he must have been murdered! This is, of course, a serious alternative; and unless circumstances tend to expose the error of the medical statement, irreparable injury may be done to an innocent person. The medical opinion has always given way when circumstances refuting it appeared; but it is the duty of a medical jurist to profit by such errors,—to apply his opinions with greater caution to similar cases, and not to wait for their refutation by incontrovertible facts.

Injuries to the Head not immediately fatal.—The following case occurred a few years since in the Norfolk and Norwich Hospital:—A boy, owing to the bursting of a gun, had the breech-pin lodged in his forehead. He got out of a cart, in which he had been brought four or five miles, and walked into the hospital without assistance. The pin was firmly impacted in the frontal bone about the situation of the longitudinal sinus. On its removal, a portion of brain came away with several pieces of bone, and the aperture in the cranium was nearly an inch in diameter. Symptoms of coma then came on, and the boy died in forty-eight hours. The brain was found to be considerably injured. ('Med. Gaz.,' vol. 18, p. 458.) Mr. Watson mentions a similar case. During a quarrel between father and son, the latter threw a poker at the former with such violence that the head of the poker stuck fast in his forehead, and was with some difficulty withdrawn. The father asked those who were near him to withdraw the weapon, and he was afterwards able to walk to the infirmary. He died from inflammation of the brain. ('On Homicide,' 62.) A case occurred to Dr. Wallace, of Dublin, in which a man fell from a scaffold on the summit of his head. He was a stunned by the fall, but on reaching the hospital, dismounted from the car which conveyed him, and walked upstairs with very little assistance. He died in three days, but he remained perfectly rational, and was enabled to get up and go to the water-closet the day before his death. On inspection, there was only a slight abrasion on the summit of the head, but the skull was found split into two nearly equal halves from the frontal bone backwards, and the longitudinal sinus was laid open throughout. In the hemispheres of the brain there was a large quantity of effused blood in a semi-coagulated state; and more than two ounces were found at the base of the skull. ('Lancet,' April 1836.) Supposing this person to have been found dead with such extensive injuries, the medical opinion would probably have been that he was not likely to have lived or moved afterwards; and yet the power of volition and locomotion remained with him for two entire days!

Dr. Cunningham, of Hailsham, mentions the case of a boy who met with an accident while firing a pistol. The pistol burst, and there was no doubt that the breech had entered the brain, although it could be nowhere perceived. The boy remained sensible for two days; and although some amendment took place, he died twenty-four days after the accident. The breech of the pistol, weighing nine drachms, was found lying on the tentorium; and the brain was much disorganized. ('Lancet,' July 1838.) In this case the boy was shot completely through the brain, a heavy mass of iron having traversed that organ, but he was not even rendered insensible by so serious a wound. (See also 'Med. Gaz.,' vol. 36, p. 38.) The medical opinion in an abstract question of this kind, is commonly based on individual experience; but the question really is, not whether the witness himself may have seen such a case, but whether such a condition of things is medically possible. If all opinions in a Court of law were to be founded on personal experience only, many medical facts, important either to the prosecution or defence, would be lost; because the witness by mere accident might never have met with such exceptional cases.

The importance of these observations will be further seen by the following medico-legal case, reported by Dr. Wallace. A man was found dead in a stable, with a severe fracture of the temporal bone, which had caused a rupture of the middle artery of the brain. A companion was accused of having murdered him, but he alleged that the deceased had fallen from his horse the day before, and met with the accident. It appeared, however, that after the fall, the deceased had gone into a public-house, before he returned to the stables, and remained there some time drinking. The question respecting the guilt of the accused party rested upon the fact whether, after such an extensive fracture of the skull, with extravasation of blood, it was possible for a man to do what the prisoner had represented the deceased to have done. Dr. Wallace gave, very properly, a qualified opinion; he said it was improbable but not impossible, that the deceased could, after receiving such an injury, have gone and drunk at a public-house. The extravasation was here the immediate cause of death, and probably this did not take place to the full extent, except as a consequence of the excitement from drink.

It is easy to suggest many cases in which a question of this kind will be of material importance. For instance, a man may fall from a height, and produce a severe compound fracture of the skull. He may, nevertheless, be able to rise and walk some distance before he falls dead. (See case, *ante*, p. 404.) Under these circumstances there might be a strong disposition to assert that the deceased must have been murdered,—the injuries being such that they could not have been produced by himself, there being at the same time no weapon near, and no elevated spot from which he could have fallen. The discovery, after death, of severe injury to the head, with great effusion of blood on the brain, must not lead a surgeon to suppose that the person who sustained the violence had been immediately incapacitated. In *Reg.* v. *Milner and others* (Derby Summer Assizes, 1854), in which a Mr. Bagshawe had been assaulted by the prisoners and had died from the injuries sustained, it was proved that the temporal bone was beaten in, the base of the skull fractured, and there was a large coagulum of blood effused on the left side of the brain, which by its pressure had flattened this organ. Notwithstanding these injuries, deceased walked a considerable distance, and he survived about twelve hours. There is reason to believe that in this and other cases of a similar fatal kind, the effusion of blood was an after-result.

Wounds of the heart not immediately fatal.—Every penetrating wound of the heart was formerly considered to be instantaneously mortal, and the usual medical opinion at coroners' inquests was, that a person so wounded must have dropped down dead on the spot. More accurate observations have, however, shown that this is an erroneous, and in medico-legal practice, a highly dangerous doctrine. The *Duc de Berri*, who was murdered in Paris in 1820, survived eight hours after having received a wound of the left ventricle. Other and more remarkable instances of survivorship will be adduced hereafter; in the meantime it may be stated, that, although in a surgical view, a question of this kind is of little importance, the case is very different in legal medicine. Upon it may depend the decision of questions relative to suicide, murder, or justifiable homicide. When the cavities of the heart are extensively laid open, death is likely to be an immediate result; but persons who have sustained wounds of this organ have frequently lived sufficiently long to exercise the power of volition and locomotion. Mr. Watson met with a case in which a man who had been stabbed in the right ventricle ran eighteen yards after having received the wound. He then fell, but was not again able to rise; he died in six hours. On dissection, it was found that a punctured wound had extended into the right ventricle in an obliquely transverse direction, dividing in its course the coronary artery. The pericardium was nearly filled with blood, and about four pounds were effused on the left side of the chest. ('On Homicide,' p. 98.) One of the most remarkable cases of the preservation of volition and locomotion after a severe wound will be found reported in the 'Medical Gazette' (vol. 14, p. 334). In this case the patient, a boy, survived five weeks, and employed himself during that period in various occupations. After death a mass of wood was found lodged in the substance of the heart. Had this boy been found dead with such an injury, it is most probable the opinion would have been that his death was instantaneous. Dr. Darling, of New York, has communicated to me the particulars of a case which occurred in February 1855, in which a man survived for a period of *eleven days* a bullet-wound of the heart. Soon after receiving the wound he became senseless, cold, and pulseless, and remained in this collapsed state for four hours. He then rallied, but died on the eleventh day. On inspection, there was no effusion of blood: the pericardium was much distended with serum, the result of inflammation. A bullet, one-third of an inch in diameter, was found lodged in the septum or fleshy partition between the right and left ventricles, about midway between the apex of the heart and base of the ventricles. There was no communication with the cavities—the wound had entirely cicatrized; and inflammation of the pericardium was obviously the cause of death.

The following case, reported by one of the editors of Beck's 'Medical Jurisprudence,' will show the bearing of this medico-legal question. It was here material to the defence of the prisoner. The keeper of a brothel was tried in Glasgow, in the year 1819, for the murder of a sailor, by shooting him through the chest. It appeared from the evidence of the medical witnesses, that the auricles and part of the aorta next to the heart were 'shattered to atoms,' by the slugs and brass nails with which the piece was charged; and in their opinion, the deceased must have dropped down dead on the moment that he received the shot. The body was found in the street, and the door of the prisoner's house was *eighteen feet* up an entry; so that it followed, if the medical opinion was correct, that the prisoner must have run after the deceased, and have shot him in the street. For the prisoner it was urged and proved, that he had shot the deceased through the door of his own house, which the latter was attempting to enter by force. Besides direct testimony to this effect from those within the house, and from a lad who was with the deceased at the time, it was proved that there was a stream of blood from the door of the house to the spot where the body lay, which could not have flowed from the body towards the house, as the threshold of the door was on a higher level than the pavement of the street. On this evidence, the prisoner was acquitted. If, by the heart 'being shattered to atoms,' we are to understand that its cavities were entirely laid open, and its substance destroyed, we have a description of wound which most professional men would not hesitate to pronounce instantaneously mortal. Although nothing is stated on the point, yet we must suppose it was proved, before the question of survivorship was raised, that the body of the deceased could not have been dragged after death from the door of the prisoner's house to the spot where it was found; a circumstance which would have sufficed to account for the presence of a stream of blood, notwithstanding the difference of level between the street and the door of the house. The question was of importance to the prisoner, inasmuch as if he had shot the deceased while the latter was endeavouring to break into his house, the homicide might have been regarded as excusable; but, if after the deceased had left the house, he had run into the street and shot him, then probably this would have been considered sufficient evidence of malice to have justified a verdict of wilful murder. The jury adopted the first view of the case; and, therefore, found that the deceased in spite of the severe wound had had the power to run into the street, after having been shot through the door of prisoner's house.

A case of some interest in reference to the power of surviving a severe wound of the cavities of the heart, occurred at Guy's Hospital, in February 1854, for the particulars of which I am indebted to Mr. Callaway. An Italian, æt. 38, discharged a brace of pistols into his chest on the left side. The man was brought to the hospital, was able to converse on his condition, and lived one hour and fifteen minutes after the infliction of the wound. After death it was found that one bullet had perforated the pericardium, entered the right ventricle, and, after traversing the septum of the ventricles, made its exit from the heart at the junction of the left auricle with the ventricle. It traversed the upper lobe of the left lung, and was found fixed in one of the vertebræ of the back. The second bullet perforated the left ventricle, and then traversed the left lung. This wound was of such a nature, that at every contraction of the ventricle, the opening must have been closed so as to arrest the flow of blood. This man, owing to severe suffering, rolled about the floor, and was with difficulty kept quiet. It will be seen that in this case there were bullet-wounds traversing completely the cavities of the heart; yet the man could talk and exert himself, and he actually survived their infliction *one hour and a quarter*. Had the body been found dead in a suspicious locality, the discovery of such wounds in the ventricles of the heart might probably have led to a medical opinion that the death of the man must have been instantaneous. In these cases, little or no blood probably escapes from the heart in the first instance, but it may afterwards continue to ooze gently, or suddenly burst out in fatal quantity. It must not, therefore, be supposed, when a person is found dead with a wound of the heart, attended with abundant hæmorrhage, either that the flow of blood took place in an instant, or that the person died immediately and was utterly incapable of exercising any voluntary power. Only one condition will justify a supposition of this kind; namely, when the cavities of the organ are largely laid open. This remark applies especially to wounds of the auricles, which have but little contractile power.

Wounds of the carotid arteries not immediately fatal.—Questions relative to the power of locomotion perhaps more frequently occur with respect to wounds of the great blood-vessels of the neck than of the heart—suicide and murder being more commonly perpetrated by the infliction of such wounds. Wounds of the carotid arteries are often pronounced *instantaneously* mortal. A witness may deliberately state that the person could not possibly have survived an instant. This is a very hazardous opinion, for it occasionally comes out, on inquiry, that if such a wound had been instantaneously mortal, then, in defiance of rational probability, or of the strongest presumptive evidence to the contrary, the deceased must have been murdered! A medical opinion of this kind has not only been refuted by circumstances, but by the evidence of eye-witnesses. A medical witness is then compelled to admit that his rules for judging of the mortality of wounds are wrong, and that the person may have survived for a longer or shorter period. There are several cases on record which show that wounds involving the common carotid artery and its branches, as well as the internal jugular vein, do not prevent a person from exercising voluntary power, and even running a certain distance. Mr. Clegg, coroner for Boston, informed me that, in 1863, he held an inquest on the body of a man, who committed suicide by cutting his throat. The common carotid artery and the jugular vein were cut through to the bone, and in spite of the loss of a large quantity of blood, the man lived half an hour. In a case of murder, perpetrated at Kingston, in March 1831, it was proved by medical evidence, that the deceased died from a wound in the throat, which cut through the right carotid artery, jugular vein, and windpipe. The wound had been inflicted while deceased was lying in bed. Her body was found in an adjoining room, and the circumstances showed that after receiving the wound, she had been able to rise from her bed, and to stagger or run to the distance of about six feet. In the case of *Rex* v. *Danks*, Warwick Lent Assizes, 1832, it was proved that the deceased had died from a wound in the throat inflicted by the prisoner, which divided the trunk of the carotid artery, the principal branches of the external carotid, and the jugular veins. The evidence rendered it probable, if not certain, that after the infliction of this wound, the deceased had been able to run twenty-three yards and to climb over a gate—the time required for the performance of such acts being at least from fifteen to twenty seconds. Most medical witnesses would have probably given an opinion that the deceased could not have moved from the spot where such a wound had been inflicted; but it was clear that she had gone this distance—there was no dragging of the body, and no motive for its being dragged by the prisoner, and exposed in an open road, where it was found. ('Medical Gazette,' vol. 10, p. 183.) Such cases as these show the necessity of caution in giving an opinion respecting immediate death from wounds. When the internal jugular vein has been the principal vessel involved in a wound, a similar question has presented itself. The power of moving has been exerted to a considerable extent. (See the case of *Reg.* v. *Dalmas*, p. 442: also 'Annales d'Hygiène,' 1830, p. 417.)

There is one circumstance which requires notice in relation to severe wounds in the *throat*—namely, that although a person may have the power of locomotion, he may not be able to use his voice so as to call for assistance. It sometimes excites surprise at an inquest, how a murder may, in this way, be quietly committed without persons in an adjoining room hearing any noise; but the fact is well known medically, that when the windpipe is divided, as it generally is on these occasions, the voice is lost.

Ruptures of the diaphragm.—A rupture of the *diaphragm* has been considered sufficient to deprive a person of the power of locomotion; but there appears to be no good ground for this opinion. The general effect of such an injury is to incapacitate a person; but still in some cases a power of moving and walking may be retained after a rupture of this muscle. In the following instance, reported by Devergie, the proof of locomotion was material:—An intoxicated man, after having been maltreated by another, returned home, walking for at least two hours with two companions. The man died in fifteen hours; and, on inspection, among other severe injuries, there was found a recent longitudinal rupture of the diaphragm about two inches and a half in extent, and the stomach protruded through the aperture. The question was, When could this rupture have taken place? for it was undoubtedly the cause of death. Was it possible for a person, with a recent rupture of the diaphragm, to walk for two hours? If this power of locomotion were admitted, then it followed that it might have been caused by the man who first ill-treated the deceased; if not, then that the injury had been probably caused by the deceased's two companions, for it did not appear that he had been in company with any other person. The medical witness admitted the possibility of the deceased being able to walk under the circumstances, but he thought it very improbable. There was not the smallest evidence to show that the deceased had been attacked or beaten by his two companions in journeying homewards; and, therefore, there could be no just reason for inferring their guilt, simply because locomotion after such an injury was something unusual as a matter of medical experience. This injury is far from being immediately or even speedily fatal, as was formerly supposed. In January 1847, a case was communicated to the Pathological Society of London, concerning which the following particulars were ascertained. A man fell from a height of twenty feet. He had fractured both arms, and had sustained other severe injuries; on the day after admission into the hospital, he complained of a fixed defined pain on the left side. He survived about thirteen weeks. On inspection, the diaphragm was found lacerated in two places; in one to the extent of an inch, and in the other to the extent of six inches. ('Med. Gaz.,' vol. 39, p. 205.) In a case admitted into Guy's Hospital, a few years since, the patient survived the only accident which could have produced the rupture for at least *nine months.* The man had fallen on the deck of a vessel, from a great height, six months prior to his admission. His ribs were fractured, and one ankle was so injured as ultimately to render amputation necessary. The man sank under the operation three months after admission; and on inspection it was found that the stomach and the colon occupied the left side of the chest, having protruded through an aperture in the muscular part of the diaphragm, two and a half inches in extent. It was evidently of old standing, as the aperture was cicatrized and the omentum adhered to it. The existence of this injury was quite unexpected, and, at the time of admission, there was nothing to interfere with locomotion and exertion, except the injury to the ankle. ('Guy's Hospital Reports,' 1138, p. 368.)

Ruptures of the liver, spleen, or kidneys, unless attended at once with great loss of blood, do not prevent a person from exercising muscular power. In the case of *Gordon* (Glasgow Spring Circuit, 1856), it was proved that the deceased had died from ruptured liver; but after sustaining the violence, he had been able to reach home on foot, although with some difficulty. This question of survivorship in reference to ruptured liver, and the time required for fatal effusion of blood to take place, may often have an important bearing in a charge of murder. (See post, *Reg.* v. *Phillips*, Liverpool Winter Assizes, 1863.)

Ruptures of the bladder.—In ruptures of the *bladder*, attended with extravasation of urine, a question may arise respecting the retention of the power of locomotion. The following cases will show that this power does sometimes exist, although the general result is, perhaps, to incapacitate the individual from moving. A man, aged thirty-one, while intoxicated, received a blow on the lower part of his abdomen. He was sobered by the accident, and walked home, a distance of a quarter of a mile, although suffering severe pain. When seen in the evening, twelve ounces of bloody urine were drawn off by a catheter, and he complained of having felt cold immediately after he had received the blow. He died four days after the accident. On inspection there was no mark of bruise or ecchymosis on any part of the abdomen. The bladder was ruptured in its upper and back portions for about an inch. ('Lancet,' May 14, 1842.) Another case was related to me by a pupil. A gentleman who had been compelled to retain his urine, fell accidentally, in descending a staircase, with the lower part of his abdomen against the edge of one of the steps. The sense of fulness in his bladder immediately ceased, and he walked to a friend's house to dinner. The nature of the accident was mentioned to a surgeon there present, who immediately suspected that the bladder must have been ruptured. The case terminated fatally in twenty-four hours. A case is reported by Mr. Hird, in which a man walked a distance of two miles after having sustained a rupture of the bladder; and in another, which occurred in January 1852, communicated to me by Mr. Rake, the man, who sustained the injury in a scuffle, was able to walk a mile between two and three hours after the occurrence. (See also 'Lancet,' Oct. 31, 1846, p. 480.) Thus, then, from these various instances, it is evident that locomotion and muscular exertion may take place after an accident of this description. The medico-legal relations of this subject will be apparent from the following case, reported by Mr. Syme. A man passed some hours convivially with a few friends, after which a quarrel ensued, blows were exchanged, and the parties wrestled with each other. The deceased then walked home, a distance of more than a mile; and in crossing the threshold of his own door, he fell forwards on his abdomen. When lifted up he complained of great pain, and was put to bed, being quite unable to exert himself. He died in two days, and upon dissection, the bladder was found ruptured at its upper part (fundus) to the extent of between two and three inches. Under these circumstances, it became a question whether the rupture was caused by the violence of his companions, or by the accidental fall at the door of his own house. If by his companions, he must have walked more than a mile with his bladder ruptured; but two medical witnesses declared that he could not have walked this distance after the rupture, and consequently that it must have been occasioned by the subsequent fall. The symptoms of rupture and extravasation of urine occurring immediately after the fall rendered it highly probable that this accident was really the cause. At the same time it is obvious that the power of locomotion may be exerted under such circumstances to a much greater extent than is commonly supposed.

The question is sometimes restricted to the mere possibility of *survivorship for a given period* without active exertion. If the power of locomotion is retained under severe injuries to important organs, there can be no difficulty in supposing that life may continue for a longer or shorter time when the individual remains in a quiescent state. Dr. Tardieu has lately reported a case in which, under attempted abortion, the uterus was extensively lacerated, and the greater part of the small intestines had been torn away. These injuries had caused a great loss of blood, but the woman was reported to have lived three quarters of an hour, and to have cried out during that time. Some medical witnesses thought that such violence could not have been sustained without leading to immediate death. A review of the facts, however, and an examination of parallel cases, satisfied Dr. Tardieu that the deceased might have survived and cried out in the manner deposed to by the witnesses.

('Ann. d'Hyg.,' 1848, vol. 1, p. 157.) The cases contained in this chapter fully corroborate the opinion formed by M. Tardieu. A witness must always be prepared to make full allowance for acts indicative of life in persons severely wounded.

Under survivorship from severe accidents or personal injuries, this power of moving, if not exerted to a large extent, may take place in a small degree; and this may become occasionally a material question in legal medicine. Thus it must not be lost sight of, when we are drawing inferences as to the relative position of an assailant and a murdered person from the situation in which a body is found. A dead man, with a mortal injury to the head or heart, may be found lying on his face, when he actually fell upon his back, but still he might have retained sufficient power to turn over before death: or he may have fallen on his face, and have afterwards moved so that his body may be found lying on the back. A slight motion of this kind is very easily executed; it does not always depend on volition. Individuals suffering from severe concussion have been frequently known to perform acts unconsciously and automatically. The cases above related may perhaps be considered rare, and as exceptions to the general rule. The medical jurist must bear in mind, however, that he is not required to state in how many, out of a given number of persons similarly wounded, this power of performing acts indicative of volition and locomotion may remain, but simply whether the performance of these acts is or is not *possible.* It is on this point only that the law requires information. The hypothesis of guilt, when we are compelled to judge from circumstances in an unknown case, can only be received on the exclusion of every other reasonable explanation of the facts. On surgical opinions or treatment, such cases, from their rare occurrence, may have little influence; but in legal medicine the question is widely different. Medical facts, however rare, here admit of a very important and unexpected application.

Struggling after severe wounds.—Although, in cases of severe wounds, we may allow that persons may survive for a sufficiently long period to perform various acts of volition and locomotion, yet the presence of a mortal wound, especially when of a nature to be accompanied by a great loss of blood, must prevent all *struggling* or violent exertion on the part of the wounded person; such exertion we must consider to be quite incompatible with his condition. A medical jurist may thus have it in his power to determine whether a mortal wound found on the deceased has been inflicted for the purpose of murder, or in self-defence, as the following case, reported by Mr. Watson, will show. A man was tried at the Lancaster Assizes, in 1834, for the murder of a woman at Liverpool, by stabbing her in the chest. Prisoner and the deceased, with two other females, were quarrelling in the passage of a house. A struggle ensued between the prisoner and deceased, which one of the witnesses said lasted for *ten minutes.* When the prisoner had reached the door, he pulled out a knife and stabbed the deceased in the chest. She fell, and died almost immediately. The prisoner alleged that he was attacked by several persons, and that he stabbed the woman in self-defence. The judge said, if the blow had been struck with premeditation before the struggle, the crime would be murder—if during the struggle, it would be manslaughter. The medical evidence showed that the blow could not have been struck before the struggle, because it was of a speedily mortal nature; and the deceased would not then have been able, as it was deposed to by the witnesses, to struggle and exert her strength with the prisoner for *ten minutes* afterwards. This being the case, it followed that in all medical probability the deceased had received the wound towards the conclusion of the quarrel; and therefore it might have been inflicted while the prisoner was attempting to defend himself. The jury returned a verdict of manslaughter.

A case involving this medico-legal question was tried at the Gloucester Lent Assizes, 1843 (*Reg.* v. *Hobbs*). The prisoner was indicted for the wilful murder of a man with whom he had been drinking and quarrelling. It appears that in the early part of the quarrel the deceased threw the prisoner down and struck him unfairly. The deceased was told by the landlord of the inn to go home. He replied 'Very well,' and then leaving the prisoner, went through the entrance-arch of the inn up the yard, which was his usual way of going home. In about *seven minutes* the deceased, who had complained to the landlord of the maltreatment which he had undergone, returned into the inn-yard, and was seen on entering it, to pull down his waistcoat and button his coat. A witness advised him to go home, and he left the spot. A short time afterwards he was found at the back of the yard, lying on his face and quite dead. On examining the body it was ascertained that the deceased had been stabbed in two places, one of the stabs having penetrated a ventricle of the heart. On apprehending the prisoner, a large clasp knife was found in his pocket stained with blood. The prisoner admitted that he had stabbed the deceased, but said it was *during the quarrel*, and that he had used the knife in self-defence while they were on the ground. This was the defence. For the prosecution it was contended that the deceased had been stabbed by the prisoner subsequently to the quarrel—that he had gone through the gate into the yard to meet the deceased, had there stabbed him, and had caused his instant death. A medical witness who was called, stated at first, that from such a wound death must have been *instantaneous*. In cross-examination, however, he admitted that the deceased might have lived some time after he had been stabbed; and on this evidence the prisoner was convicted of manslaughter, and sentenced to six months' imprisonment. The medical facts of this case are rather imperfectly reported: hence it is difficult to give a decided opinion respecting the time at which the deceased was stabbed in the heart. This, like every other case, must be judged by the special circumstances accompanying it. The size of the stab in the ventricle is not stated; nor is it in evidence whether any blood was found on the spot where the deceased was struggling with the prisoner. That the deceased should have struggled with the prisoner for one minute after he had been stabbed in a ventricle of the heart, is contrary to all medical experience and probability. It is also irreconcilable with the existence of such a wound, that the deceased should have spoken to the landlord—that he should not have called the attention of the latter to the fact of his having been stabbed by the prisoner while struggling with him—that he should have been stabbed in the heart without knowing it, or without being aware of his condition—that he should have been able thereafter to walk away through the inn-yard to the house, and survive seven minutes while thus walking; and yet all these circumstances must have happened, in order that the defence, and the verdict based upon it, should be true. Taking the facts as reported, it appears to me that it is impossible to arrive at any other conclusion than that the deceased was stabbed by the prisoner subsequently to the quarrel, while he was walking in the inn-yard. The only circumstance for the defence were the prisoner's statement, and that, in some rare cases, certain wounds of the heart do not prove immediately fatal.

The case of *Reg.* v. *E. M. Brown* (Dorchester Summer Assizes, 1856), presents some points of interest in reference to the question under consideration. The prisoner was charged with the murder of her husband by blows on the head while in her room. Her statement was that the violence on the head was produced by the kick of a horse. The medical evidence showed that the bones of the nose were broken: there was a triangular wound exposing the bone above the left eyebrow, another triangular wound exposing the bone at the top of the head, and a third wound at the back of the head. The left ear was perforated; and behind it was a long wound divided into two. The frontal bone was fractured from the orbit through the parietal into the occipital bone. Seven pieces of bone, varying in size from half an inch to three inches, had been driven into the brain, and a large quantity of blood was effused. The prisoner's account was that she found her husband thus wounded and bleeding outside the house, that she dragged his body into an inner room, and, further, that though thus wounded, he held her tightly by the clothes for two hours afterward. It was proved that there was no blood over the front of the person or dress of the deceased, and that there was no blood in the passage or in any part of the house, except in the room where the body was found lying. Further, the injuries were not such as a kick from a horse would explain; and the medical witness properly stated that a man thus injured could not have held the prisoner by the clothes for two hours, so as to prevent her from seeking earlier for assistance. The medical facts showed that the deceased had been killed by blows where the body was actually found. The prisoner was convicted.

CHAPTER 44.

WOUNDS AS THEY AFFECT DIFFERENT PARTS OF THE BODY—WOUNDS OF THE HEAD—OF THE SCALP—CONCUSSION—HOW DISTINGUISHED FROM INTOXICATION—EXTRAVASATION OF BLOOD—SEAT OF—AS A RESULT OF VIOLENCE, DISEASE, OR MENTAL EXCITEMENT—WOUNDS OF THE FACE—OF THE ORBIT—OF THE NOSE—DEFORMITY AS A CONSEQUENCE OF WOUNDS OF THE FACE—INJURIES TO THE SPINE—FRACTURES OF THE VERTEBRÆ—DEATH FROM INJURIES TO THE SPINAL MARROW.

The *danger* of wounds, and their *influence in causing death*, are the two principal points to which the attention of a medical jurist must be directed.

WOUNDS OF THE HEAD.

Incised wounds, affecting the scalp, unless of great extent, rarely produce any serious effects. When the wound is contused, or accompanied by much laceration of the skin, it is highly dangerous in consequence of the tendency which the inflammatory process has to assume an erysipelatous character. The results of these wounds are, however, such as to set all general rules of prognosis at defiance. Slight punctured wounds will sometimes terminate fatally in consequence of inflammation, followed by extensive suppuration; while, on the other hand, a man may recover from a lacerated wound by which the greater part of the skin may have been stripped from the bone. There are two sources of danger in *wounds of the scalp*:—1. The access of erysipelatous inflammation. 2. Inflammation of the tendinous structures, followed or not by a process of suppuration. Either of these secondary effects may be a consequence of slight or severe wounds and prove fatal. Neither can be regarded as an unusual result of a severe wound of the scalp, but when one or other follows a slight injury, there is reason to suspect that the patient may have been constitutionally predisposed to the attack. Bad treatment may likewise lead to a fatal result from a wound not serious in the first instance, but the question,—how far the responsibility of an aggressor would be affected by a circumstance of this nature has been considered in another place (*ante*, p. 481). Wounds of the head are dangerous in proportion as they affect the brain; and it is rare that a severe contused wound is unaccompanied by some injury to this organ. There is, however, a difficulty which a practitioner has here to contend with—namely, that it is scarcely possible to predict from *external* appearances, the degree of mischief which has been produced within. These injuries, as it is well known, are capricious in their after-effects,—the slightest contusions may be attended with fatal consequences, while fractures, accompanied by great depression of bone, and an absolute loss of substance of the brain, are sometimes followed by perfect recovery. ('Cormack's Jour.,' Sept. 1845, p. 653; 'Med. Gaz.,' vol. 39, p. 40; and 'Phil. Med. Exam.,' Nov. 1845, p. 696.) Another difficulty in the way of forming a correct opinion consists in the fact, that a person may recover from the first effects of an injury, but after some days or weeks he will suddenly die; and on examination of the body, the greater part of the brain will be found destroyed by suppuration, although no symptoms of mischief may have manifested themselves until within a few hours of death. (For a medico-legal account of injuries to the head, see a paper by M. Toulmouche, 'Ann. d'Hyg.,' 1859, vol. 2, p. 395, and 1860, vol. 1, p. 143.)

Concussion.—The common effect of a violent blow on the head is to produce concussion or effusion of blood, or both. Concussion is usually indicated by fainting, insensibility, or sudden death occurring immediately after the application of external violence. In concussion the symptoms come on *at once*, and the patient sometimes dies without any tendency to reaction manifesting itself. In the most severe form, the person drops at the very moment when struck and dies on the spot. (Chelius's 'Surgery,' vol. 1, p. 408.) In other cases, he may linger in a state of insensibility for several days or weeks and then die. In concussion there is generally more or less vomiting. It is important to remember that neither compression nor physical injury to the brain is necessary to render concussion fatal. (See p. 470: also Travers's 'Constitutional Irritation,' p. 438; Chelius's 'Surgery,' vol. 1, p. 410.) This may be entirely dependent on shock to the nervous system. After death, no particular morbid change may be discovered in the body, or there may be merely the mark of a slight bruise on the head. In *Reg.* v. *Burgess* (Liverpool Lent Assizes, 1845), the deceased, who was the subject of violence, fell and died on the spot, and there was no appearance of injury externally or internally. The state of insensibility observed in concussion may be only apparent. Some consciousness may be retained (p. 33).

Inflammation may follow the primary shock from concussion—suppuration may take place, and the patient die after the lapse of several weeks, or even months. (See case 'Med. Times and Gaz.,' June 30, 1860, p. 645.) It is important in a medico-legal point of view to notice that a person may move about and occupy himself, while apparently convalescent, for a week or ten days after recovery from the first shock, and then suddenly be seized with fatal symptoms, and die. This apparent recovery leads to the common supposition, that death must have been produced by some intervening cause, and not by the original violence to the head, a point generally urged in the defence of such cases. When the inflammation that follows concussion is of a chronic character, the person may suffer from pain in the head and vomiting, and die after the lapse of weeks, months, or even years. (See p. 478: also Travers, op. cit. p. 445; also Hoffbauer 'Ueber die Kopfverletzungen,' 1842, p. 57.) Concussions may sometimes take place as a consequence of a violent fall on the feet, in which case the head receives a shock through the medium of the spinal column. The skull may be thereby extensively fractured at the base, and the brain may be even shattered by such a fall. This was the cause of death in the case of the late *Duke of Orleans.* ('Med. Gaz.,' vol. 36, p. 368.)

In *Allen* v. *the Chester Railway Company* (Court of Common Pleas, Feb.

1857), the plaintiff claimed damages for injury caused by a railway collision. The evidence showed that the plaintiff received a blow on the head. There were no immediate effects; but in two days the plaintiff suffered from lightness of the head and other symptoms, attributed by his medical attendant to *concussion* of the brain, as a result of the accident. Subsequently there were symptoms of injury to the spine. There was pain in the course of the spine, partial paralysis of the bladder, rectum, and lower extremities, with loss of memory. The medical witnesses for the plaintiff attributed these symptoms to a blow received by him at the base of the skull. The defendants contended that if these were the results of concussion of the brain, they ought to have manifested themselves immediately on the occurrence of the accident; and this view was to some extent supported by the evidence of experienced surgeons. In substance, however, the medical evidence on the two sides was not conflicting. Concussion of the brain, as it is ordinarily known to surgeons, is generally attended with some *immediate* symptoms; but the witnesses for the defence properly admitted that 'a concussion of the brain (and spine?), attended with apparently slight symptoms at first, might, under peculiar circumstances, be followed by serious symptoms.' As no other cause could be assigned for the symptoms, this was practically admitting that the plaintiff had suffered from the injury, the degree being simply a question for the jury. They returned a verdict for the plaintiff.

Concussion distinguished from intoxication.—The symptoms under which a wounded person is labouring may be sometimes attributed to *intoxication*, and a medical witness may be asked what difference exists between this state and that of concussion. The history of the case will, in general, suffice to establish a distinction, but this cannot always be obtained. It is commonly said that the odour of the breath will enable a surgeon to detect intoxication; but it is obvious that a man may meet with concussion after having drunk liquor insufficient to cause intoxication, or concussion may take place while he is intoxicated,—a combination which frequently occurs. Under such circumstances we must wait for time to develope the real nature of the case. Concussion may be so slight as sometimes closely to resemble intoxication, and from the absence of all marks of violence to the head and the existence of a spirituous odour in the breath, the medical examiner might be easily deceived. If there be no perceptible odour in the breath, the presumption is that the symptoms are *not* due to intoxication. On the other hand, intoxication may be so great as to give rise to the apprehension of fatal consequences, and the co-existence of a mark of violence on the head might lead to error in the formation of an opinion. What is the line of conduct to be pursued on such occasions? The examiner should weigh all the circumstances, and if there be one cause for the symptoms more probable than another, he should adopt it:—if there be any doubt, this should be stated to the Court.

There is nothing in the state of the brain in a dead body, which will enable a practitioner to distinguish whether concussion or intoxication had existed and had been the cause of the symptoms. The vessels may be congested in both cases. The discovery of alcoholic liquid in the stomach may lead to a presumption that deceased had been intoxicated, while marks of violence on the head may favour the view that he had suffered from concussion. When both conditions are found, the examination of the body cannot lead to a solution of the question. The answer must then depend on the special circumstances proved, and, if procurable, on the nature of the symptoms preceding death.

It is to be feared that medical witnesses are not sufficiently careful, on these occasions, to determine whether there are signs of intoxication about an injured person. Subsequent proceedings may render this a material part of the inquiry. In November 1851, the house-surgeon of a London hospital was severely reprimanded by a magistrate, in consequence of an omission to inquire and satisfy himself whether, in addition to the results of violence, a policeman who was brought to the hospital, was or was not intoxicated when admitted. The question was of importance; the injuries to the head might have arisen from a fall, and a drunken man might readily meet with such injuries from accident. A person was charged with an assault on the policeman, but upon very suspicious evidence; and, in fact, could intoxication have been proved or rendered probable, there would have been no ground for the charge. The medical man had already certified that the patient was not intoxicated, but when pressed in cross-examination, could not say whether he was or was not. The case was immediately dismissed. There can be no excuse for not making a full inquiry into the precise condition of an injured person, and arriving at the best judgment of which the case admits. A state of intoxication often renders it difficult to form an accurate opinion in a case of alleged criminal wounding; but it is always in the power of a witness to satisfy himself by close examination—the use of the stomach-pump or simply watching the patient, whether he is in a state of drunkenness or whether he is labouring under the effects of disease or violence. In more than one instance within a recent period persons who have been struck with incipient symptoms of apoplexy in the street have been seized and locked up as drunk, and have afterwards been found dead or dying! Others, who have suffered from violence, have perished from neglect under a similar mistake made by a medical man. Disease of the brain as well as injuries to the brain from violence, may give to a man a staggering gait and may render him helpless: they are also commonly accompanied by vomiting. If it should happen that shortly before such an attack, the person has taken beer, wine, or spirits, sufficient to give an alcoholic odour either to the breath or the matter vomited, it is at once treated as a case of drunkenness, and the unfortunate person is left to his fate. The death of a Mr. *King*, in London, October 1864, furnishes an instance of the necessity of a more rigorous examination of the facts on these occasions. He was pronounced to be labouring under drunkenness, and handed over to the police. When examined by another surgeon the next morning, it was found that his skull was fractured, and that he was otherwise severely injured. He died from the effects. Some instructive cases, in reference to this complication of wounds, have been published by M. Tardieu. (See 'Med. Gaz.,' vol. 44, p. 347.)

Extravasation or effusion of blood.—A blow on the head may destroy life by causing an effusion of blood either on the surface or in the substance of the brain. In pugilistic combats, when a person is thus struck, he commonly falls, and death may take place in a few minutes. On inspection, blood may be found effused either at the base or in the ventricles of the brain, and the question will present itself—Did the injury which caused death arise from *a blow or a fall*? Two cases of this description are reported by Dr. Wharrie. The men were knocked down by blows with the fist, and they were taken up dead. (Cormack's 'Monthly Jour.,' Feb. 1846, p. 117.) It is not easy to give an answer to this question, and its relevancy in a legal view is not apparent; for as it is presumed the blow was the cause of the fall, it follows from recent decisions that the assailant would be responsible for the effects of either or both. In a case of this kind (*Reg.* v. *Williams*, Denbigh Lent Assizes, 1856), in which deceased had received a blow and sustained a fall, and his death was clearly proved to have resulted from the violence, the judge directed the jury, if the death was caused by 'the fighting,' to return a verdict against the prisoners. They, however, according to the usual practice of Welsh juries, persisted in returning a verdict of not guilty; assuming that the fatal injury was caused by the fall and not by the blow! A heavy blow on the head may cause fatal effusion of blood, but in these instances the effusion commonly arises from the violent concussion which the injured person sustains by the fall. A medical witness will therefore in general be compelled to admit that the fatal effusion might have taken place either from a blow or a fall. If the fall has resulted from accident and not from a blow, this will, of course, absolve the accused from responsibility for the fatal results. (See page 397.)

This subject has important applications in legal medicine, for this is one of the most common causes of death from injuries to the head, and there are generally many cases of this description tried at the assizes. Effusion may occur from violence, with or without fracture, and it may take place without being accompanied by any external marks of injury. In the case of the *Queen* v. *Phelps* and others (Gloucester Aut. Ass. 1841), it was proved that there was great effusion of blood, and even laceration of the brain, without any corresponding external injuries on the deceased. (See also, at the same Assizes, the case of the *Queen* v. *Thomas.*) The late Dr. Griffiths, the American editor of a former work, mentions a case which was the subject of a trial at Massachusetts, in which a person received a blow from a small stone, and died in ten minutes. On examination there was no external bruise or fracture of the bones: the ventricles were filled with coagulated blood, and all the vessels were gorged with blood. It was observed that the skull was in this instance unusually thin (p. 287, Amer. ed.). The chief source of the effusion in violence to the head arises from a rupture of the meningeal artery, and this may occur from a mere shock or concussion, with or without a fracture of its bony canal. The blood thus effused acts by compressing the brain; this compression does not always cause death unless the blood is in large quantity, or unless it is effused in or around the base of the brain (medulla oblongata). Thus the hemispheres will bear a degree of compression from blood which, if it affected that portion of the base of the brain from which the spinal marrow proceeds, would instantly destroy life. The most fatal effusions, therefore, are those which take place in a fracture of the base of the skull, whereby one or both lateral sinuses are commonly ruptured. There may, however, be laceration of the brain with effusion of blood to some extent at the base, and yet the person may survive some days. Dr. Paterson, of Edinburgh, communicated to me a case which occurred in February 1854, in which a woman survived for a period of twelve days severe injuries to the head supposed to have been inflicted by her husband. She was insensible during the whole of this time; some of the external marks of violence had nearly disappeared, and undergone the usual changes of colour. A severe blow had obviously been inflicted on the summit of the head. On inspection after death it was found that there had been laceration of the brain by counter-stroke, and a large clot of blood was observed to occupy the lacerated part, extending over the surface of the base of the brain and into the ventricles. In this instance the woman survived a severe injury for an unusually long period. In the case of *Cuming* (Edinburgh, Dec. 1853), the deceased, the wife of the prisoner, died on November 8, from laceration of the brain produced by blows on the head, inflicted by the prisoner, on October 26. The woman lay in a state of insensibility during the whole period of thirteen days. In a case admitted into Guy's Hospital, July 1856, death as a result of effusion of blood from injury to the head, did not take place until the twelfth day. The patient, æt. eighteen, received a blow on the head during a fight. He did not suffer much in consequence, and continued his employment during the next ten days, but on the eleventh day, owing to his having head-ache, he came to the hospital. He walked to his bed, and appeared quite rational, but he was depressed, and there were febrile symptoms. He died during the night. Dr. Wilks, who reports this case, found on inspection bruises on his arms, but the head presented no outward sign of injury, and the bones were not fractured. On removing the outer membrane (dura mater) the right half of the brain was surrounded by effused blood which had compressed it. It was contained in the cavity of the arachnoid membrane. The brain presented no breach of surface or laceration from which the blood could have issued, and its substance was healthy. Four ounces of blood in a fluid state were collected. There was a loose coagulum of a slightly brown hue, and under this there were other coagula of a light ochreous colour adherent to the brain and dura mater, showing that the blood had been effused some days. These coagula were in membranous layers, and under the microscope presented a fibrous texture. ('Guy's Hospital Reports,' 1859, vol. 5, p. 123.) This case shows the insidious nature of injuries to the head, and that an injury may prove fatal without leaving any marks of violence externally or appearance of laceration of vessels or brain-substance internally. A man while intoxicated was thrown down and struck his head against the pavement. He was taken up insensible, the wound was dressed, and he partially recovered his senses. Three days afterwards he was brought into Guy's Hospital in a state resembling that of concussion. There was a scalp-wound at the back of the head on the left side. He remained in a lethargic state, being occasionally affected with fits of convulsions. About a week after his admission he sank into a half comatose state, and occasionally screamed out. The pupils became finally contracted (as in narcotic poisoning), and he died on the 15th of November, *twenty-five days* after the infliction of the violence. Dr. Wilks found, on inspection, a layer of blood an inch thick covering the right hemisphere of the brain. The clot was thready, of a dull-red colour, and in some parts of a yellow or ochreous tint, showing from these changes in the red colouring matter, that the blood had been effused for a considerable time. On two portions of the base this yellow clot was closely adherent to the brain, and on removing it this was found to be bruised and softened. The source of the blood had been from some ruptured vessels of the inner membrane (pia mater) at this spot. None of the larger arteries or venous sinuses were found injured, and there were no inflammatory products. ('Guy's Hospital Reports,' 1859, vol. 5, p. 122.)

In cases of injuries to the head proving fatal by *effusion* of blood on the brain, a person may recover from the first effects of the violence, and apparently be going on well, when he will suddenly become worse, and die. Effusion takes place slowly at first,—it may be arrested by the effects of stupor from concussion, by a portion of the blood coagulating around the ruptured orifices of the vessels, or by some other mechanical impediment to its escape; but after a longer or shorter period, especially if the person be excited or disturbed, the bleeding will recur and destroy life by producing compression. How many hours or days are required in order that such an increased effusion should take place after an accident, it is impossible to say; but in severe cases, it is generally observed to follow the injury within a short time. Sir Astley Cooper has related the case of a gentleman who was thrown out of a chaise, and fell upon his head with such violence as to stun him in the first instance. After a short time he recovered his senses, and felt so much better, that he entered the chaise again, and was driven to his father's house by a companion. He attempted to pass off the accident as of a trivial nature, but he soon began to feel heavy and drowsy, so that he was obliged to go to bed. His symptoms became more alarming, and he died in about an hour, as it afterwards appeared, from effusion of blood on the brain. When the brain has sustained laceration from violence, in addition to insensibility, convulsions are frequently observed.

Effusion of blood from disease or violence.—Blood may be found effused in various situations within the interior of the skull; and the cause of the effusion may be either disease or violence. The skill of a medical jurist is often required to determine which of these causes is the more probable, as where, for instance, a pugilist has died, after having received severe injuries to the head, and his adversary is tried on a charge of manslaughter. On these occasions it is often urged in the defence, that the bleeding might have arisen either from a diseased state of the vessels of the brain, or, if the evidence render it probable that the blow was the cause,—that the effects of the blow were aggravated by a diseased condition of the vessels, or by the excitement into which the deceased was thrown, either from the effects of intoxication or passion. When the brain is not lacerated by violence, the blood is effused either on the surface of the hemispheres, between the membranes, or at the base. When the effusion is caused by violence, the effused blood is not always found under the spot where the blow was inflicted, but occasionally, by counter-stroke on the surface of the brain, directly opposite to it:—a case which a medical witness has frequently been required to explain on trials, and which depends on the same cause as fracture by counter-stroke, *i. e.* on a separation of parts (laceration of the brain, effusion of blood, or even fracture of the bones) at the point of the skull directly opposite to that which sustains the violence. Dr. Paterson's case above related (*ante*, p. 522) furnishes a good instance of extensive injury by counter-stroke. A severe blow had been inflicted on the summit of the head, as the mark was plainly visible, but the fatal injury was found in the base of the brain, *i. e.* on the part opposite to that which received the blow. Here the brain was lacerated and blood effused. Again, fracture of the base of the skull is frequently the result of severe violence applied to the top of the head (vertex). (See case by Dr. Haworth, 'Med. Gaz.,' vol. 36, p. 368.) Effusions of blood from a diseased state of the vessels more commonly take place in the substance of the brain, but they sometimes occur on the surface of the organ as a result of mere excitement or over-exertion of the muscular powers. A diseased condition of the vessels, and probably a softening of the substance of the brain, will on these occasions be apparent on inspection.

In a case which occurred in 1840, a boy, aged twelve, died suddenly with comatose symptoms, after violent exertion. On inspection, half a pint of blood was found effused on the surface of the brain. ('Lancet,' Nov. 1840.) This case is the more remarkable, because it is rare that a spontaneous effusion from disease should occur in so young a person. Then again it must be remembered, that under the effects of violence when the brain participates in the injury, blood may be effused in its substance so as to resemble cerebral hæmorrhage from disease. Thus when the skull has sustained violent blows without fracture, the extravasated blood has been observed to proceed from the minute vessels of the pia mater and choroid plexus. A singular case is reported ('Lancet,' Jan. 11, 1845, p. 51), where a blow on the neck over the jugular vein caused instantaneous death, apparently from effusion of blood in the brain. Another fatal case from the same cause is referred to, in which a large quantity of blood was found effused in the lateral ventricles. Dr. Traill mentions an instance which occurred at Liverpool in 1838, in which a blow with the naked fist entirely divided the external carotid artery in a healthy man, who died very speedily. ('Outlines,' p. 89.)

If the effusion depend on *disease*, the arteries around may be found in a diseased condition, or the brain itself may be found softened and disorganized. The state of the brain and its vessels should be closely examined in all cases of alleged violence, since hæmorrhage may take place either from excitement or slight blows, whenever this diseased condition exists. It has occasionally happened, especially in old persons, that the person has dropped down dead without a blow being struck, and that death has been wrongly imputed to violence. Cerebral hæmorrhage from disease rarely occurs in persons under forty years of age. Frequent intemperance and violent passion may, however, easily create a tendency to it in younger subjects. As an effect of violence it may take place in persons of all ages, but when the marks of violence are slight, a witness must exercise great caution before he alleges that the extravasation was produced by a blow, especially when it is found that the deceased was of intemperate habits. For a very full account of the circumstances accompanying extravasation from violence, see Brach's 'Chirurgia Forensis Specialis,' p. 63, Köln, 1843.

Another condition besides intoxication and passion has been said to favour a rupture of vessels and an effusion of blood on the brain—namely, a thickened state of the substance of the left ventricle of the heart. According to some pathologists, this morbid condition favours the occurrence of cerebral hæmorrhage by the force with which the ventricle propels the blood to the brain. Unless the brain is softened and the vessels are diseased, it is, however, doubtful whether this condition of the heart would have much influence. A case was tried at the Central Criminal Court (Aug. 1836, *Reg.* v. *Brown*), in which the prisoner owed his acquittal entirely to the deposition of the medical witness as to the condition of the heart. It was proved that the deceased had been much maltreated by the prisoner about the face and head, and that he speedily died, to all appearance, from the violence. On inspection, the medical witness stated that he found the left ventricle of the heart considerably thickened and dilated, and that under excitement this morbid condition had probably led to the effusion of blood on the brain, and death. Upon this evidence Baron Gurney directed an acquittal.

As a summary of these remarks, we may say that in effusions of blood from violence, the blood generally issues from a vessel which is plainly seen to be torn, as the middle artery of the brain or the lateral sinus; it is commonly found on the surface of the brain, and not in its substance, unless the organ be lacerated. When situated between the dura mater and skull, more especially when immediately below the seat of violence or directly opposite to it by counterstroke, this is strong evidence, *cæteris paribus*, that it has proceeded from a blow. When there is a fracture of the skull, the presumption of the extravasation being due to violence is great; because this is not only a sufficient, but a very obvious cause, while the idea of its having proceeded from disease only is remote and speculative. When, besides these conditions, there is no remarkable congestion of the brain in other spots, the substance of the organ is firm, and the vessels are to all appearance free from disease, we have the strongest reason to believe that the effusion must have been due to violence, and to no other cause whatever. At the trial of *Edey* (High Court of Justiciary, Edinburgh, Nov. 1847), it was proved that the deceased had died from effusion of blood on the brain, and the question was, whether this had arisen from a blow or from disease. The medical witness deposed that he found no marks of disease in the blood-vessels of the brain, and his opinion was that it had resulted from violence. The prisoner was convicted. A case of some interest in relation to this question has been communicated to the 'Lancet' by Mr. H. Kyd (Nov. 13, 1847, p. 521). An effusion of blood which led to sudden death after a blow on the mouth during a pugilistic encounter, was however in this instance considered to have arisen from excitement.

The evidence given on some trials, when the main question has turned upon the *cause* of an effusion of blood in the case of a person who has sustained violent injuries to the head, has rather tended to reflect disgrace on medical science. It has been made to appear from the mouth of the medical witness, either directly or by implication, that no sort of mechanical violence applied to the head of a man in a state of drunkenness or passion,—of one whose cerebral vessels were probably diseased,—or the substance of whose heart might be thickened,—could have had any effect in producing a fatal extravasation found in the head after death. In spite of an individual having received a violent blow with a bludgeon, sufficient to have killed a stout and vigorous man, or of his having been thrown with considerable force with his head against a stone-floor, an unrestricted admission is often made, that excitement alone, or drunkenness alone, would account for the extravasation without reference to the blow. In putting the most favourable construction upon these cases, when we have clear evidence of great violence having been used to the head, with the presence of the usual post-mortem appearances, our opinion should be that the excitement or drunkenness might have predisposed to, but was not the immediate cause of, the cerebral hæmorrhage. There seems to be no good reason for assuming that apoplexy from natural causes always occurs, by a peculiar coincidence, just at the time that a person receives a violent blow with a bludgeon on the head, or for giving to the assailant the benefit of this hypothetical explanation.

A mere inspection of the body does not always lead to the discovery of the cause of an effusion on the brain. The violence causing an effusion of blood may have been slight, and unless attention is particularly directed to the subject, it may be overlooked. In the case of a female who died in a London hospital, in August 1857, there was no fracture of the skull or external injury to account for effusion of blood on the brain. The brain was not injured, and in fact there was no apparent cause of death but the effusion, and this was somewhat precipitately assigned to disease. A certificate of death from 'apoplexy' was given, and the deceased was buried. It subsequently transpired that she had been maltreated by her husband, and that the effusion of blood was owing to the maltreatment! The condition of the effused blood should be accurately noticed, in order to determine whether it presents any marks indicative of its being recent or of old standing.

Spontaneous effusions or effusions from disease are not easily distinguished from those which are the result of violence to the head. Dr. Wilks has pointed out that in most instances of *severe* injury attended with effusion of blood, the structure of the brain is found bruised. In meningeal apoplexy (apoplexy of the membranes) the source of the blood is a vein of the pia mater or inner membrane, and sometimes a large arterial trunk. The difficulty chiefly arises in those cases in which effusion is found after slight violence, and there is, at the same time, disease of the blood-vessels of the brain. Dr. Wilks gives the results of several inspections in which effusion was owing to disease—to violence, and to a mixed condition. (See 'Guy's Hospital Reports,' 1859, p. 120.)

Effusion of blood from excitement.—When engaged in the investigation of these cases, it is always a fair matter of inquiry whether the *violence*, upon the evidence, was not of itself sufficiently great to account for the effusion without the supposition of coexisting disease or excitement. Admitting that the rupture of a blood-vessel, and the extensive effusion of blood on the brain, may take place from simple excitement and passion, yet this is an event comparatively rare, at least in the young and healthy, while nothing is more common than that these results should follow violent injuries to the head, whatever the age or condition of the person. A medical witness should remember that on these occasions, if he is unable to say positively whether the effusion was due to the excitement or the blows, he will satisfy the Court if he only state clearly that which is, in his own mind, the more probable cause of death; and by weighing all the circumstances of the case beforehand, he will rarely fail to find that one cause was more probable than the other. Thus, if a man, excited by passion and intoxication, is struck on the head, and the blow is slight—such as an unaffected person would probably have sustained without injury—yet in this case insensibility and death follow, and, on examination, a quantity of blood is found effused in the substance of the brain, can it be a matter of doubt with the practitioner that the effusion was chiefly due to the excitement under which the deceased was labouring? To take a converse instance—a man engaged in a personal conflict with another, is struck most violently on the head, or falls with great force on that part of his body: on inspection it is found that death has arisen from effusion of blood on the surface of the brain, and it would be no unexpected consequence of the violence inflicted, that a similar appearance should be met with in an individual calm and unexcited:—Can the practitioner hesitate to say, under these circumstances, that the blow would satisfactorily account for the effusion, without reference to any coexisting causes of excitement? These may be allowed to have their influence, in giving an increased tendency to cerebral hæmorrhage, or in aggravating the consequences of the blow, but no further.

In these criminal investigations, when a witness is examined in chief, he asserts, perhaps, that the extravasation of blood was owing to a blow inflicted on the head. He is then asked by the counsel who cross-examines him, whether vessels may not be ruptured by excitement: he answers, without any qualification, in the affirmative, and thus produces an impression on the minds of the jury that excitement may have caused the rupture of the vessel in the particular case on which he is being examined. This is, of course, the sort of answer which a prisoner's counsel wishes to extract from a witness; and the effect produced by it on the Court is not always removed, even by a careful re-examination. The counsel for the defence is well aware that in a case of this description, his only chance of obtaining an acquittal is to throw a degree of doubt on the medical evidence, and to render it probable to a jury that the death of the deceased party was due to some other cause than the blow inflicted by the prisoner. It may be very proper that a skilful barrister should exercise his talents in this way, but a medical witness has to remember that he is sworn to state the *whole* truth. A qualified answer should be given to what is really a general question; and, supposing his opinion to be already formed on the subject on which his evidence is required, he should not, unless it be strictly consistent with his own views, allow his answer to a *general* question to be made applicable to a *particular* case. If then asked, in cross-examination, whether vessels might not be ruptured, and blood extravasated by mere *excitement*, he should answer that such an effect might undoubtedly follow; but that it was his opinion,—and I am here supposing that his opinion has been founded upon a deliberate examination of all the *medical* facts,—that excitement was not the cause of rupture and extravasation in the case in question. A witness has, it appears to me, a right to insist that his evidence shall pass to the jury without having any designed ambiguity attached to it. It may be said that the remedy for an evil of this kind is the re-examination of the witness; but I am satisfied from the reports of many cases before me, that the point is overlooked. Besides one cannot understand why a piece of sophistry and equivocation is to be left to a chance exposure:—the case would then rest not upon sound medical evidence, but upon the relative degree of ingenuity and ability displayed by the counsel for the prosecution and defence. In a trial for manslaughter which took place some years since at Derby, it was proved that the prisoner and deceased had been wrestling. The prisoner had thrown the deceased with his head on a stone floor; he then seized him by the throat, and beat his head several times against the floor. The deceased died nineteen hours afterwards. On inspecting the body, a great quantity of coagulated blood was found beneath the scalp. There was a wound over the right parietal bone, an inch and a half in length, penetrating through the scalp; but no fracture of the skull. There was a quantity of extravasated blood on the opposite or left side of the head; and a rupture of some branches of the carotid artery on the inside of the skull. On the neck were two discolourations to the left of the windpipe, apparently occasioned by the pressure of two fingers. The laying hold of the neck might, in the opinion of the witness, have more readily caused a rupture of the cerebral vessels, by preventing the return of blood. The surgeon, after giving this description of the post-mortem appearances, was asked whether, in his opinion, death was occasioned by the injury proved in evidence. He said death might or might not have been occasioned by it. Death might have arisen from other causes—an apoplectic fit might have occasioned it. The effusion of blood had occasioned death, and he had seen blood in the heads of many persons dying from apoplexy. The cause of death was the pressure of coagulated blood upon the brain. He was not able to speak to the cause of the rupture of the vessels. He thought it highly probable that the injury received was the cause of death,—it was certainly sufficient to account for it! It is not mentioned whether the man was found guilty upon this evidence, or whether the jury acquitted him. ('Med. Gaz.,' Vol. 7, p. 382.)

A case was tried at the Gloucester Summer Assizes, 1845 (*Reg.* v. *Phipps*), in which a strong opinion was expressed by Mr. Justice Patteson, in relation to the defence frequently adopted on these occasions. During a fight, the prisoner struck the deceased a severe blow under the left ear. He fell and died in a few minutes. After death, blood was found extravasated on the part corresponding to the seat of violence, and this, in the opinion of the medical witness, satisfactorily accounted for death. The defence was, that the effusion might have proceeded from over-excitement; but the judge is reported to have said that if it were proved two people were fighting together—blows were struck—one fell to the ground and died, and afterwards internal injuries were found corresponding with the external marks of violence, no power on earth could persuade him that such blows were not the cause of death! The prisoner was found guilty.

Effusion of blood causing death after a long period of time.—Admitting that blood has been effused on the brain as a result of violence, the person injured may survive the effects for so long a period as to create a legal doubt whether death can be strictly assigned to the violence. In this respect the case of *Reg.* v. *Sullivan* (C.C.C. Sept. 1853) is of some interest. The late Dr. M'William, who gave evidence at the trial, gave me the particulars of this case. Deceased, a healthy man, was knocked down by the prisoner, and fell with his head upon the ground. He appeared as if he was stunned, and staggered in attempting to walk: he complained of pain in the head and general weakness. This was on the 11th of April, 1853. Although he suffered from pain in the head, he had no medical advice until the 12th of May, and had performed his duties as an officer of the Customs. After this he suffered from dimness of sight, and became delirious. On the 29th he came under the care of Dr. M'William. There were marks of bruises on the head, there was impairment of vision, a faltering gait, and other symptoms indicative of pressure on the brain. He improved under treatment, but the symptoms returned in an aggravated form about the 12th of June; he became insane, and was transferred to St. Luke's Hospital. Dr. Stevens, under whose care he was then placed, stated that he had delusions, and was evidently suffering from pressure on the brain. He recovered so far that he was about to be discharged, when the symptoms of pressure became aggravated, and death took place on the 17th of August, *i.e. four months* after the infliction of the violence. On inspection a shot was found imbedded in the frontal bone, not penetrating the skull. A large clot of blood existed between the layers of the arachnoid membrane, occupying the whole surface of the left hemisphere: the clot had evidently been there for some time, because it was partially invested with a false membrane. No large vessel was ruptured; there had probably been an escape of blood at different times, and this would explain the intermittent nature of the symptoms. The clot amounted to at least two fluid ounces, and the surface of the brain had been obviously indented by its pressure. Another clot of old standing was found in the pons varolii. The witnesses concurred in attributing death to the effusion of blood on the brain, and the effusion to the violence inflicted by the prisoner, although it was admitted to be probable that some additional effusion had taken place just before the last fatal recurrence of symptoms. The prisoner was convicted of manslaughter. The fact that the deceased had been healthy previous to the violence, and that after this he had constantly suffered more or less from symptoms of pressure on the brain, fully justified the medical opinion, in spite of the protracted nature of the case. There was no other cause but the violence to account for the effusion and death.

Date of effusions.—Recent effusions of blood are recognized by their red colour, and the consistency and appearance of the clot or coagulum. After some days the clots acquire a chocolate or brown colour, and this passes gradually into an ochreous tint, which may be met with in from twelve to twenty-five days after the violence (see cases by Dr. Wilks, *ante*, p. 523). Coagula of effused blood also undergo changes in structure and consistency; when old they are firmer, and there is much lymph, which is sometimes disposed in membranous layers of a fibrous structure, and these are adherent to the dura mater and the brain. The surface of this organ sometimes presents a mark indicative of pressure.

The influence of time and surface in altering the appearance of effused blood, will be evident from the following case reported by the late Dr. J. Reid ('Physiological Researches,' p. 513). A woman, æt. 70, threw herself from a window. The fall produced a severe lacerated wound of the scalp, laying bare the skull, and causing a simple fracture of the chest-bone (sternum) and leg (tibia). She died thirty-one days after the injury, in a state of exhaustion. On inspection there was a fracture of the left parietal bone, and between the dura mater and inner surface of the skull near the left temple, there was a layer of coagulated blood, one-sixth of an inch in thickness and about two inches in breadth. In one place the coagulum had a *brownish* hue, but the greater part of it was still pretty dark-coloured. On the right side there was a similar effusion of coagulated blood, but this was inside the dura mater and on the arachnoid covering of the brain (see illustration, p. 531), or within the cavity of the arachnoid. This coagulum was everywhere of a *chocolate-brown* colour, showing that the process of absorption was much more advanced than on the left side. A large quantity of coagulated blood had been effused into the cellular tissue near the fracture of the large bone of the leg. This was still black, and had the appearance of a recent effusion. A small quantity of black blood was also found near the chest-bone, which had been fractured. The fractured ends of the bones had been firmly united. There is no doubt that all these effusions had taken place at the same time from the same accident, i.e. 31 days before death, yet they presented very different appearances; and but for the facts being known, it might have been contended that the effusion on the arachnoid from the great change of colour was of much older date than the others. The difference, however, was probably owing to absorption being more active in the inner surface of the serous membrane than in the other structures in which blood was effused. In estimating time, as indicated by change of colour, we must therefore always consider the seat of the effusion and the absorbing power of the tissues.

Dr. Reid also mentions a remarkable case of effusion of serum in the ventricles of the brain in the case of a young man, who died about a week after he had received a blow on the right side of the face. It appeared, however, that he had sustained a severe injury to the head eighteen months before, and certain changes in the brain, as well as the appearance of the effusion, rendered it probable that it was really of old date, and that it had been caused by the first accident and not by the blow on the face. (Op. cit. p. 517.)

When a medical man is required to give an opinion of the *date* of an effusion found on the brain, great caution is required. A surgeon may not be able to fix the precise date, but it may be in his power to say whether the blood has been effused for a few days, weeks, or months. Mr. Greaves, of Derby, consulted me on a case which was tried at the Derby Lent Assizes, 1859, in which this question was material. On the 25th of January a man was kicked violently on the head by two companions. He was attended by a surgeon for fourteen days, and he was then pronounced to be convalescent. On the 6th of March, six weeks after the assault, the man became seriously ill, and he died on the 11th of March. The two men were tried for manslaughter; and at the trial a medical man deposed that the deceased died from the effects of the injuries inflicted by the prisoners on the 25th of January. The post-mortem appearances were, congestion of the brain, with effusion of a large clot of blood on the surface of the left hemisphere, immediately below the situation of the most serious external wound, this clot being surrounded by a considerable quantity of coagulable lymph. The prisoner's counsel then put the question to the witness: 'I can produce evidence to show that deceased fell down some steps into a cellar, upon his head, three weeks before his death—do you not think it more likely that death was the result of this fall, rather than of the beating three weeks prior to the fall?' The surgeon at once said: 'Certainly not;' and continued, 'there could not have been the effusion of lymph I describe after an accident within so short a space of time as three weeks. There must have been a longer space of time between the injury and the death to have produced this appearance.' The reasons for so strong an opinion were not extracted in cross-examination, or it might have transpired that the witness had not seen any case to justify it. So far as the description goes, there was nothing to show that the effusion had been there more than three weeks. Coagulable lymph may be found in these effusions within a much shorter period than three weeks, as the following case, which occurred to Mr. Greaves, will prove. A man fell from a height upon his head, was ill for three days, and then so far recovered that he sat up and dressed himself; on the next day he became insensible, and died on the eighth day after the accident. On inspection, the base of the skull was found fractured, the fracture including both orbits; there was effusion with much lymph at the base of the brain. In the case which was the subject of trial, the situation of the effusion beneath the seat of violence was in favour of its being caused by that violence, but there was nothing in the appearance of the effusion to enable a medical man to say whether it had taken place either six weeks or three weeks before death. The perfect intermediate recovery was somewhat adverse to the theory that the clot was produced by the violence of the prisoners.

When the force is of a bruising kind, the whole substance of the skull may be fractured without a division of the skin (*The Queen against Ward*, Cent. Crim. Court, 1841). There is one remarkable circumstance connected with fractures accompanied by depression of bone, which here requires to be mentioned—namely, that the person has been sensible so long as the foreign substance which produced the fracture and depression remained wedged in the brain, and that insensibility and other fatal symptoms began to manifest themselves only after its removal. This being admitted, it may be urged in defence, that death was really caused by medical interference. But it is a sufficient answer to state, that the wounded person must have died from inflammation of the brain if the foreign body had been allowed to remain; and that it is consistent with the soundest principles of practice to remove all such foreign substances without delay. In fractures of the skull, with depression, it may become a question whether the surgeon raised the depressed portion of bone so soon as he ought to have done. (See case, Henke 'Zeitschrift der S. A.' 1838. 'Erg. H.' 230.)

Wounds of the Brain.—Wounds of the brain sometimes prove instantaneously mortal, even when slight, while in other cases, recoveries take place from contused or punctured wounds of this organ, contrary to all expectation. When a person survives the first effects of the injury, there are two sources of danger which await him: 1. The production of fungus from the exposed portion of the brain; and 2. Inflammation and its consequences. The process of inflammation, it must be remembered, is very slowly established in this organ; it may not manifest itself until from three to ten weeks after the injury. In one remarkable case, where a child was accidentally shot through the brain, the ball having traversed both hemispheres, no symptoms of cerebal inflammation manifested themselves for twenty-six days. The child died on the twenty-ninth day. ('Med Gaz.' vol. 39, p. 41.)

In the description of injuries of the head, it is impossible to avoid the use of terms with which members of the legal profession are not likely to be acquainted. In giving evidence upon the situation of wounds, of the effusion of blood, and the effects of fractures, medical witnesses are often compelled to make use of anatomical terms, and are not always successful in explaining them. With the view of removing this difficulty, and supplying, to some extent, the means of following the evidence of a witness in his description of injuries to the head and its contents, some engravings of the brain and its membranes are annexed.

Fig. 1 represents a section of the bones of the skull, with the three membranes which cover the brain. (*a*) Section of the skull-bones, with the outer and inner table, and the intermediate cellular structure or diploe, indicated by the dark shading; the scalp, or skin of the skull, which covers the outer table is not represented. (*b*) The dura mater or outer membrane of the brain; it is thick and fibrous, closely adherent to the inside of the inner table of the skull, but smooth on the side towards the brain. (*c*) The tunica arachnoides, so named from its delicate web-like structure, smooth towards the dura mater, but closely covering the pia mater beneath. (*d*) The pia mater—the membrane which immediately invests the substance of the brain and dips into all the convolutions. It contains the blood-vessels which nourish the hemispheres of the brain. These membranes are, for distinctness, represented as being separated from each other, but they are naturally in close proximity. The ordinary seats of the effusion of blood from violence are between the dura mater and inner table of the skull, and between the pia mater and the surface, or in the substance of the brain.

FIG. 1.

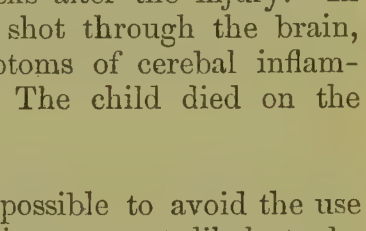


Fig. 2 represents a horizontal section of the brain from front to back. 1, 1. The two *hemispheres* cut down, forming what is called the *centrum ovale.* The greater part of this consists of white medullary or brain substance, studded with small red points (the sections of small blood-vessels) called *puncta cruenta* or *vasculosa.* It is surrounded by a narrow margin, darkly shaded, which represents the grey or cineritious substance, from its having a darker colour than the mass of the brain. The depth to which the *convolutions* of the brain extend into its substance is here seen, and it is into these that the pia mater or investing membrane dips. 2 and 3 represent in section the fore and back parts of the *corpus callosum,* or the body by which the two hemispheres are united. The removal of this has exposed the two great cavities of the brain, one in each hemisphere, called the *lateral ventricles.* These are here seen with their contents. 4. Part of the *septum lucidum,* showing a slight space between its layers, which is called the fifth ventricle. 5, 6, 7, are prolongations of the cavities or ventricles, front and back, which from their shape are called cornua (horns). 8. The *corpus striatum* of one ventricle. 9. A dark fringe-like looking body called the *choroid plexus*; it consists of a fold of membrane (pia mater) enclosing numerous blood-vessels. This plexus communicates with that of the opposite ventricle through the foramen of Monro. A bristle is passed through the opening under 4, and its extremities are seen resting on the corpus striatum on each side. 10. A portion of the *thalamus opticus* of one ventricle. 11. The fornix. 12. The hippocampus major, descending into the middle cornu.

Fig. 2.

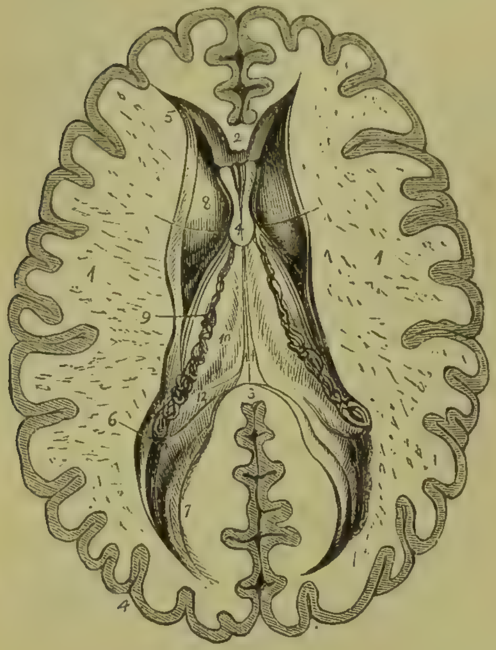
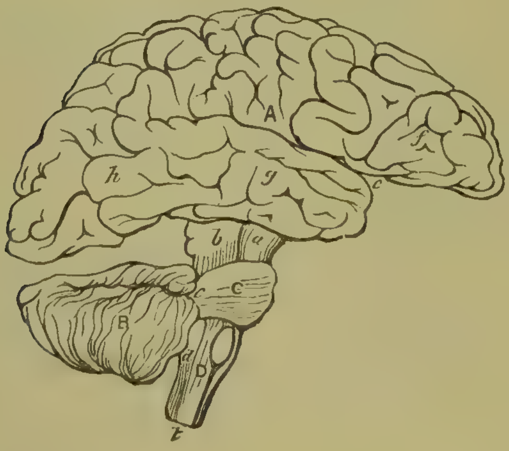


Fig. 3 represents in outline a lateral view of the various parts of the brain, somewhat separated from each other. The membranes are removed, and the convolutions exposed. A. The cerebrum; *f*, *g*, *h*, its anterior, middle, and posterior lobes; *e*, the fissure of Sylvius between the anterior and middle lobes. B. The cerebellum, or lesser brain. C. The pons Varolii. D. The medulla oblongata, or commencement of the spinal marrow. *a*, Peduncles of the cerebrum. *b*, *c*, *d*, Superior middle and inferior peduncles of the cerebellum.

Fig. 3.



Wounds of the face.—When wounds of the face are of any extent they are usually followed by great deformity; and when they penetrate the cavities in which the organs of the senses are situated, they often prove fatal, either by involving the brain and its membranes, or by giving rise to inflammation in this organ. Wounds of the eyebrows are not of so simple a nature as might at first sight be supposed. Besides being attended by deformity when they heal, they are liable to give rise, during the process of healing, to serious disorders of the neighbouring parts. Amaurosis and neuralgia are recorded among the secondary and not unusual consequences of such wounds, when the supra-orbitar nerve has become implicated. Under certain conditions of the body, there may be inflammation of the parts within the orbit, extending by contiguity to the membranes of the brain, and proving fatal by leading to the formation of matter within that organ. Amaurosis in the right eye has been known to occur from a contused wound, not of a violent nature, to the right eyebrow. Dr. Wallace, of New York, has reported two cases of amaurosis following blows over the infra-orbitar nerve. ('Med. Gaz.' vol. 31, p. 931.) Wounds apparently confined to the external parts of the face frequently conceal deep-seated mischief. A sharp instrument penetrating the eyelid, and passing upwards with any force, will produce fracture of the orbitar plate of the frontal bone, which is known to be extremely thin, and even injure the brain beyond.

Wounds of the orbit.—Sir Astley Cooper relates, that a girl while playing with a pair of scissors, accidentally fell, and the point of the scissors passed upwards under the upper eyelid. It was found difficult to extract them; the eye became inflamed, but for some days after the accident the child was in the habit of walking a considerable distance daily to receive medical advice. In about ten days she suffered violent pain, with symptoms of inflammation of the brain, under which she died. On inspecting the body, it was found that the orbitar plate of the frontal bone had been fractured, the dura mater torn, and the anterior lobe of the brain lacerated. (For a similar case, see 'Med. Gaz.' vol. 41, p. 553.) In several instances in this country, trials for murder have taken place, in which death has been caused by a penetrating wound of the orbit, leading to fracture of the orbitar plate and injuring the brain. In the year 1735, the celebrated *Macklin*, the comedian, was tried for having caused the death of Thomas Hallam, by thrusting a stick into his eye. On inspecting the body of the deceased, it was ascertained that the stick had entered the brain through the orbit; the prisoner was found guilty of manslaughter. A somewhat similar case occurred at Liverpool, in February 1843, where a boy killed another by wounding him with a gimlet in the eye. The brain was perforated, and he died in two days. It is necessary for a witness to bear in mind that, owing to the thinness of the orbitar plate, an injury of this kind may be produced by the application, comparatively speaking, of only a moderate force. The following instance, reported by Mr. Watson, will show that a simple cause may produce a serious wound of the orbit. A boy, aged ten, had the birch end of a common broom, thrust several times into his face by one of his companions. He became stunned, and was carried home in a state of stupor. He afterwards complained of violent pain in the eye-ball and forehead. Symptoms of inflammation and fever supervened, followed by coma, convulsions, and insensibility. He died in about sixteen days after the accident. On dissection, the orbitar plate was found perforated, and pus and lymph were effused at the base of the brain. The left ventricle contained three ounces of pus, and communicated with a wound in the orbit. A small portion of bone was partially separated from the orbitar plate, and projected upwards. For many similar cases, and one in which death took place in six hours, from a wound made by a tobacco-pipe, see 'Hoffbauer ueber die Kopfverletzungen,' 1842, p. 49. In infants and children, the partition between the orbit and the brain is almost membranous, and it may therefore be perforated by the slightest causes. A man was tried in Scotland, in 1827, for killing a girl, by shooting her. The prisoner had inadvertently discharged a gun towards the high road, where the deceased was standing; she received the shot in her face, but the wounds appeared quite superficial. She died in three days, and it was found that one small pellet had penetrated the orbitar plate and perforated the brain. It would appear, from a case reported by Dr. Scott, that the orbitar plate need not always be perforated, in order that fatal inflammation of the brain should be set up. A deeply penetrating wound of the orbit only, has caused death under the usual symptoms of cerebral disturbance. ('Ed. M. and S. J.,' vol. 43, p. 263.) For a remarkable case of wound of the brain through the orbit reported by Dr. Neumann, see Casper's 'Wochenschrift,' May 1845.

Wounds of the nose.—These wounds are, generally speaking, of a simple nature, rarely giving rise to serious symptoms; but they are almost always attended with great deformity. If the injury is contused and, at the same time, extensive, a loss of the faculty of smelling will probably result. A penetrating wound of the nose, produced by passing a sharp-pointed instrument up the nostril, may destroy life by perforating the cribriform plate of the ethmoid bone, and injuring the brain. Such a wound, it is obvious, might be produced without leaving any external marks of injury. The late Dr. Corkindale, of Glasgow, met with a case in which a man died in nine weeks from the effects of a wound of the nose, whereby the nasal bones were fractured. On inspection, there was a copious inflammatory effusion at the surface of the brain, particularly at the part corresponding to the seat of the violence. An injury to the bones of the nose may prove fatal by giving rise to an attack of tetanus. A case of this kind has been elsewhere related (*ante* p. 488).

Deformity as a consequence of wounds of the face.—Wounds of the face when at all extensive, are always followed, in healing, by greater or less *deformity*. A medical witness may, perhaps, find these questions put to him in relation to them: Is the wound likely to be attended with deformity? Could such a wound of the face heal without deformity?—or, Could the deformity, if it exist, have been produced by any other cause than the wound? These questions are of some importance. A person may allege that he was severely wounded in the face, when the medical witness, on examination, may find no trace of such a wound as that described. Again, a person may seek damages from another in a civil action, by alleging that a particular deformity was produced by a wound, when the medical witness may be able to trace its origin to disease, or to some accidental cause.

INJURIES TO THE SPINE.

Injuries to the spine and spinal marrow seldom require medico-legal investigation; but this organ is liable to *concussion* from blows, to compression from fracture of the vertebræ or the effusion of blood, with all the secondary consequences attending such accidents. Concussion of the spinal marrow commonly produces paralysis, affecting the bladder, rectum, or lower extremities. These symptoms may not appear at once, but come on after some hours or days. (*Bowling* v. *S. E. Railway*, Exchequer, Feb. 1859; also *Williamson* v. *London and Brighton Railway Co.*, Guildford Summer Assizes, 1862.) After death no traces of mechanical injury may be discovered. Blows on the spine, unattended with fracture or dislocation, may, according to the observation of Sir B. Brodie, be followed by inflammation and softening of the spinal marrow. A slight injury has been known to cause death, by giving rise to inflammation of the spinal marrow. (See Henke's 'Zeitschrift der S. A.' 1840, 2, 407.) This organ is also liable to compression from slight causes, as will be evident from the following medico-legal case reported by Dr. King, of Glasgow:—A man was tried on a charge of manslaughter. It appeared in evidence that he had thrown the deceased on the ground, and while he was attempting to rise, he caught him by the throat, forced him backwards, and brought his head violently in contact with the ground. Deceased died after a few convulsive gasps. On inspection, the spinal cord was found to be compressed between the body of the fourth and the arch of the third vertebra, but on removing it, no indentation or laceration of its substance was perceptible. Death had ensued from paralysis of the phrenic nerves. It is remarkable that so slight a degree of violence should have caused so serious an injury, for the affair took place before eye-witnesses. This case shows the necessity of inspecting the vertebral column, when death is alleged to have been caused by violence, and no traces of it are perceptible in other parts of the body. Indeed, it is not improbable that in most cases of sudden death from alleged or suspected violence, where the cause is obscure, if the spinal marrow were examined, the fatal result might be explained, by the discovery of some mechanical injury or morbid change in this organ. This part of a medico-legal inspection is, however, commonly neglected.

Fractures of the vertebræ.—These fractures are generally attended by displacement, and thus produce compression of the spinal marrow. They are the more rapidly fatal, in proportion as the injury is high up in the vertebral column. The whole of the body becomes paralyzed below the seat of injury, by the compression of the spinal marrow. If the seat of compression is above the fourth cervical vertebra, death is commonly immediate: asphyxia results from paralysis of the nerves which supply the diaphragm, and which are necessary to respiration. In falls on the summit of the head from a height, it sometimes happens, not only that the skull is extensively fractured, but that the dentiform process of the second vertebra is broken off, owing to the head being doubled under the body. This injury to the second vertebra may be the cause of death. From a case related by Mr. Phillips, it would appear that this accident is not always attended by fatal compression of the spinal marrow. ('Ed. M. & S. J.' Jan. 1838.) In one instance the individual survived fifteen months (ib. Oct. 1845, p. 527); and in another, in which the fracture was caused by the patient turning in bed while his head was pressed on the pillow, death did not take place for *sixteen* months. (Copland, 'Dict. Pr. Med.,' Paralysis.) On several criminal trials, this injury was proved to have been the cause of death: and in a case tried at Glasgow (the *King* against *Reid*, p. 27), it became a material question, how far such a fracture might result from disease. It may happen that caries of the bone, or disease of the transverse ligament will cause a separation of the dentiform process from the second cervical vertebra. The state of the bone in these alleged fatal accidents should, therefore, be closely examined. In Reid's case an acquittal took place, partly because the deceased had laboured under disease of the spine, and the exact state of the parts had not been noticed. Disease of the ligaments may also lead to a separation, followed by slow or rapid death, according to the degree of pressure. A slight cause may sometimes produce severe and fatal injury to the neck. A case occurred not long since, where a lunatic in a private asylum suddenly threw her head back, in order to avoid taking some food that was offered to her; and she died evidently from the compression produced by the displacement of the dentiform process of the second vertebra. A woman died suddenly a month after her confinement: she had been suckling her child at one o'clock in the morning, and at four she was found dead. The viscera of the abdomen, thorax, and head were carefully examined, without the discovery of any morbid appearance to account for her death—when, as the brain was being returned into the skull, one of the inspectors noticed a projection at the foramen magnum. On further examination, the dentiform process of the second vertebra was found to have been displaced, and this had so injured the spinal marrow as to destroy life. ('Med. Gaz.' 3, 582.) It is not stated whether the bone was in a healthy or diseased condition. The following case shows that the rapidity of death will depend on the degree of compression:—A girl had a stiff neck, as it was supposed, from cold: her head was continually twisted to the left side, but she possessed the power of moving it in the opposite direction. While in this state, a man suddenly seized her and gave her head a violent twist; she felt immediately severe pain, lost the power of turning her head to the right, and had difficulty of swallowing. These symptoms continued to increase for a month, and she ultimately died from a paralytic affection. On inspection, the ligaments of the first and second vertebræ were found ruptured, but there was no mark of suppuration. The bones were healthy. The dentiform process had compressed the anterior columns of the spinal marrow, which were softened; it was observed during life that she had lost more of the power of motion than of sensation. ('Gaz. Médicale,' Nov. 1842.) A displacement of the dentiform process may take place from very slight causes. In a case which occurred to Petit, a child was instantaneously killed in consequence of its having been lifted up by the head. There was no doubt that, by the weight of the body, and perhaps a sudden jerk, the ligaments which confined the second vertebra to the first had become lacerated, and had produced fatal compression of the spinal marrow. (For another case, see Cormack's 'Edinburgh Journal,' April 1845, p. 314.) A man while holding his head in a butting position during a struggle with a friend died suddenly. The friend had forcibly rotated or twisted the deceased's head a few times from side to side by the brim of his hat. On inspection, it was found that the first four cervical vertebræ were fractured—the ligaments were bruised and torn, and blood was effused on the coverings of the spinal cord. This fully accounted for death. ('Med. Times and Gaz.' May 17, 1856.) It is not stated whether there was any disease of the bones. Compression of the spinal marrow sometimes arises, though rarely, from *effusion* of blood from a fall. It is important to remember, that an effusion of blood may also take place from spontaneous causes. In one case, which proved fatal, from an accidental fall, a coagulum of blood was found effused into the substance of the spinal marrow, exactly opposite a fracture of the body of the sixth cervical vertebra.

Injuries to the spine and its contents are generally the result of falls or blows, either on the head or the lower part of the column. The secondary consequences of these injuries are sometimes so insidious as to disarm suspicion, and death may take place quite unexpectedly some weeks after the accident. Spicula of bone, separated by fractures, may remain adherent for some time; and, by a sudden turn of the head, be forced off, and destroy life by penetrating the spinal marrow, at a long period after the infliction of the injury. This has been known to happen in fractures involving the margin of the foramen magnum, and in such cases death is immediate.

The spinal marrow has been in some instances wounded in its upper part by sharp-pointed instruments introduced between the vertebræ. Death is an instantaneous result when the wound is above the third cervical vertebra:—there is no part of the spine where a weapon can so easily penetrate as this, especially if the neck be slightly bent forward. The external wound thus made may be very small, and if produced with any obliquity by drawing aside the integuments, it might be easily overlooked, or it might be set down as superficial. For a medico-legal account of a case in which death occurred from a stab in the back of the neck, causing a division of the spinal marrow, see Henke, 'Zeitschrift der S. A.' 1836, H. 2; and for another case of homicidal injury to the spine, reported by Dr. Eade, see 'Lancet,' May 1855, p. 520.

In fractures of the vertebræ, a person is generally so disabled, whatever may be the situation of the fracture, that he cannot walk or exert himself. We must be prepared, however, for exceptions to this common surgical view of such injuries. On the 27th February, 1861, a man, æt. 35, was admitted into the Northampton Infirmary suffering from paralysis of the legs, and great pain in the back and in the abdomen. He could give no intelligible account of the cause of his illness. He soon died; and on a post-mortem examination, the tenth dorsal vertebra was found broken in its body and arch. There was slight displacement, but it was not such as to press upon the spinal cord. A large clot of blood was situated on the sheath of the cord; this had caused the paralysis. It was proved at the inquest that deceased met with a heavy fall on the 15th of February, but that he had walked some distance afterwards, visited several public-houses, went home intoxicated, and lay down to sleep in a yard. He awoke in the morning sober, but was unable to move his legs. In addition to paralysis, the man when admitted was labouring under peritonitis. There was no evidence that he had sustained any injury subsequently to the fall twelve days before his admission; hence there was reason to believe that, in spite of the fractured vertebra, he had not been rendered incapable of motion. There is no doubt that the effusion of blood was the cause of the paralysis, and this did not occur until some time after the fracture, as the result of slow oozing. (See for a case somewhat similar, *Reg.* v. *Slater* and *Vivian*, C. C. C., Sept. 1860. INSANITY.)

CHAPTER 45.

WOUNDS OF THE CHEST—OF THE LUNGS—RUPTURES FROM ACCIDENT—WOUNDS AND RUPTURES OF THE HEART—WOUNDS OF THE AORTA AND VENÆ CAVÆ—WOUNDS AND RUPTURES OF THE DIAPHRAGM—DIRECTION OF WOUNDS OF THE CHEST—WOUNDS OF THE ABDOMEN—DEATH FROM BLOWS ON THE CAVITY—RUPTURES OF THE LIVER, GALL-BLADDER, SPLEEN, KIDNEYS, INTESTINES, STOMACH, AND URINARY BLADDER—MEDICO-LEGAL QUESTIONS CONNECTED WITH RUPTURED BLADDER—WOUNDS OF THE GENITAL ORGANS—MUTILATION.

Wounds of the chest.—Wounds of the chest have been divided into those which are confined to the parietes or walls and those which penetrate the cavity. Incised or punctured wounds of the parietes of the chest are rarely followed by dangerous consequences. The bleeding is not considerable, and is generally arrested without much difficulty. They heal either by adhesion or suppuration, and unless their effects are aggravated by incidental circumstances, the person recovers. Contusions or contused wounds of the chest are, however, far more dangerous, and the danger is always in a ratio to the degree of violence used. Such injuries, when severe, are ordinarily accompanied by fractures of the ribs or sternum,—by a rupture of the viscera within the cavity, including the diaphragm,—by profuse bleeding,—or, as an after-effect, by inflammation of the lungs, with or without suppuration. Fractures of the ribs are dangerous for several reasons: the bones may be splintered and driven inwards, thereby wounding the lungs and causing hæmorrhage, or leading to inflammation of the pleura or lungs. In fractures of the upper ribs, the prognosis is less favourable than in those of the lower, because commonly a much greater degree of violence is required to produce the fracture. A simple fracture of the sternum or chest-bone without displacement of the bone, is rarely attended with danger, unless the concussion has at the same time produced mischief internally, which will be known by the symptoms. When, however, the bone is depressed as well as fractured, the viscera behind may be mortally injured. In a case of depressed fracture of the sternum, recorded by M. Sanson, the person died after the lapse of thirteen days; and on inspection, it was found that the fractured portion of bone had produced a transverse wound of the heart about an inch in length. The cavities of the organ had not been penetrated, but the piece of bone was exactly adapted to the depression produced by it on the parietes. (Devergie, 'Méd. Lég.' vol. 2, p. 243.) A witness will frequently be required to take into consideration the effects of contusions on the thorax, with or without fracture, in cases of death from pugilistic combats, which formerly gave rise to numerous trials on charges of manslaughter. Wounds penetrating into the cavity of the thorax are generally dangerous, even when slight, in consequence of the numerous accidents with which they are liable to be complicated. In these wounds, the lungs are most commonly injured; but, according to the direction of the weapon, the heart, or the great vessels connected with it, as well as the œsophagus (gullet) or thoracic duct, may share in the mischief.

Wounds of the lungs.—The immediate cause of danger from wounds of these organs is the consequent hæmorrhage, which is profuse in proportion to the depth of the wound and the size of the vessels wounded. Should the weapon divide any of the trunks of the pulmonary veins, the individual may speedily sink. The degree of hæmorrhage cannot be determined by the quantity of blood which escapes from the wound; for it may flow internally, and collect within the cavity of the pleura, impeding respiration. This is especially to be apprehended when the external orifice of the wound is small and oblique, and one of the intercostal arteries has been touched by the weapon. A wound of the lung is generally known, among other symptoms, by the frothiness and florid colour of the blood which issues from the orifice, as well as by the expectoration of blood. The lungs may sustain serious injury from a blow or fall, and yet there may be no external marks of violence or symptoms indicative of danger for some hours. A young man, while riding, fell from his horse on his left arm. He complained of no pain for five hours, but in twelve hours he was seized with an alarming flow of blood from the mouth. He died in the course of a few days. After death there was no mark of injury to the chest, but the right lung was ruptured posteriorly throughout its length, and much blood had been effused. ('Lancet,' November, 1842.) A case somewhat similar to this is reported by Mr. Jardine, of the Winchester County Hospital. ('Med. Times and Gaz.' Dec. 31, 1853.) A boy, aged fourteen, fell to the ground from a height of about twenty feet. He was admitted an hour after the accident, and he died in about two hours after his admission. On examination of the body twelve hours after death, there was no mark of external injury. The collar-bone was fractured, but the ribs had escaped injury. The right lung was found ruptured to the depth of four inches into its substance, and from this a large quantity of blood had escaped, which caused death. This case furnishes another illustration of the production of fatal internal injuries without any corresponding marks of violence externally. (See p. 393.) For another case of laceration of the lung without fracture of the ribs from a carriage passing over the chest, see 'Med. Times and Gaz.' Jan. 19, 1861. During the convalescence of a person who has survived the first effects of a penetrating wound of the chest, the surgeon should observe whether death, when it occurs, may not have been caused either by imprudence on the part of the patient, or by abuse of regimen or other misconduct; for circumstances of this nature may be occasionally treated as mitigatory on the trial of the assailant. It is properly recommended, that in all cases where a person is progressing to recovery, a relaxation of the antiphlogistic regimen should be made with great circumspection. Too much nourishment, too frequent talking, or any exertion, are circumstances that may cause a renewal of the bleeding and extravasation. A case is related in which a soldier died instantly from internal hæmorrhage, brought on by throwing a bowl at some nine-pins, two months after he had been apparently cured of a wound of the lungs. (Some remarks on penetrating wounds of the lungs will be found in the 'Med. Times and Gaz.' July 24, 1851, p. 98.)

Wounds of the heart.—Wounds of the heart are among the most fatal of penetrating wounds of the chest. It was formerly considered that all wounds of this organ were necessarily and instantly mortal. (See *ante*, p. 511.) Undoubtedly, when either of the cavities is laid open to a large extent, the bleeding is so profuse on the withdrawal of the weapon, that death must be immediate. But when the wound is small, and penetrates into the cavities of the heart obliquely, life may be prolonged for a considerable period; and cases are on record in which it is probable that such wounds would have healed, and the patients have finally recovered, but for the supervention of other diseases which destroyed life. Dupuytren has reported the case of a man who received a stab on the left side of the chest, on November 5th, 1831. He was brought to the Hôtel Dieu, but the symptoms under which he laboured did not lead to the suspicion that he had received a wound of the heart. The man died in eight days, of cerebral disease. On an inspection of his body, it was found that the left ventricle was wounded about the middle and a little to the right, its cavity having been penetrated in a transverse direction. The wound was three lines and a half across, and one line from above downwards. The external fibres of the organ were most separated; the openings diminished gradually, so that the internal fibres were in contact and closed the wound. A boy, in pulling a knife from a companion with the point towards him, accidentally stabbed himself in the chest. A small quantity of florid red blood escaped; he vomited, and fell to the ground. He died in eight days. The left ventricle had been perforated and one pound and a half of blood was effused in the chest. This case shows that fatal hæmorrhage is not always immediate. ('Med. Gaz.' vol. 2, p. 721.) In another instance reported by Dupuytren, five or six wounds were made by means of a saddler's needle,—most of them penetrating into the right ventricle of the heart. The man died of cerebral disease, twenty-five days after the wounds could have been possibly inflicted; for the needle was taken from him twenty-five days before his death, without any suspicion being entertained of his having wounded himself with it. The external cicatrix was visible on an inspection of the body. The quantity of blood found in the chest amounted to about three ounces, and this appeared to have proceeded from the substance of the heart. ('Med. Gaz.' vol. 13, p. 662.) For a case of sudden death as the result of an accidental wound by a fish-bone, see 'Med. Times and Gaz.' May 12, 1860, p. 667; and for cases in illustration of the fact that wounds of the heart are not instantaneously mortal, see 'Med. Gaz.' vol. 2, p. 721.

It was the opinion of Dupuytren, that these injuries were not necessarily fatal, although I believe, with one exception (*infrà*), there is no case on record in which a person has recovered from a penetrating wound of the cavities of the heart. ('Ed. M. and S. J.' Oct. 1844, 557; also 'Ann. d'Hyg.' 1846, t. 1, p. 212.) There are few, probably, who will be inclined to consider them curable; a remote possibility of simple wounds healing, and of the patient recovering, may be admitted, but until some clear instances of recovery from penetrating wounds of the cavities are reported, the majority of practitioners will continue to look upon them as fatal. From a series of cases collected by MM. Ollivier and Sanson, it appears that out of twenty-nine instances of penetrating wounds of the heart, only two proved fatal within forty-eight hours. In the others death took place at the varying periods of from four to twenty-eight days after the infliction of the wound. (Devergie, 'Méd. Lég.' vol. 2, p. 253.) These differences in the time at which death occurs, as well as the fact that wounds of the heart do not instantly destroy life, have been ascribed to the peculiar disposition of the muscular fibres of the organ, and to the manner in which they are penetrated by a weapon. Thus, as a general principle, it is stated that wounds which are parallel to the axis of the heart are, *cæteris paribus*, less rapidly fatal than those which are transverse to its axis. In a wound which divides the fibres transversely, the opening will be larger, and the hæmorrhage greater, than in one which is parallel to these fibres; and as the heart is composed of different layers, of which the fibres pass in different directions, so, in a penetrating wound of its cavities, while one set tends to separate the edges, another tends to bring them together, and thereby to restrain the flow of blood. It is this action of the fibres which renders wounds of the ventricles less rapidly fatal than those of the auricles, all other circumstances being equal (see case by Mr. Callaway, *ante*, p. 512); but a man has been known to survive a laceration of the left auricle eleven hours. In this case, which occurred to Mr. Hancock, the chest was crushed, and after death it was found that the left auricle was lacerated to the extent of an inch; nevertheless this patient survived the injury for this long period. ('Lancet,' Jan. 30, 1841, p. 655.) In another instance, where a man was stabbed through the left auricle during a quarrel, death did not take place until after the lapse of seventy-eight hours. ('Med. Gaz.' 40, 520.) In the 17th volume of the 'Medical Gazette,' page 82, a case is reported in which a person is stated to have recovered from a punctured wound of the heart; and Dr. Trugien met with a case in which a man who had been stabbed in the left ventricle survived *five* days. The wound in the heart had partly cicatrized. (See 'Med. Gaz.' vol. 47, p. 42.) The presence of a weapon in the wound, by mechanically obstructing the effusion of blood, also retards the fatal result. A lunatic, about thirty-four years of age, wounded himself with a very long sharp instrument on the left side of the chest. Two days afterwards he was admitted into the Bicêtre, labouring under oppressed breathing, intermittent pulse, and other serious symptoms. The wounded man stated that he had plunged the instrument into his chest, and had not been able to withdraw it. His symptoms became more aggravated, and he died on the twentieth day after the wound. On inspection, the pericardium and the surrounding parts were found inflamed; and on opening the heart an iron stiletto was discovered to be firmly imbedded in the substance of the left ventricle, which it had entirely traversed, so that its point projected a few lines into the cavity of the right ventricle. The man had obviously died from effusion of blood; but this had taken place slowly, and only after the period of time mentioned had the bleeding sufficed to destroy life. It appears from the observations of M. Ollivier and others, that the right cavities of the heart are more frequently wounded than the left, and of these the right ventricle is most commonly the seat of injury. Out of sixty-four cases of wounds of this organ, twenty-nine were situated in the right ventricle, twelve in the left ventricle, nine in the two ventricles, three in the right auricle, and one in the left auricle. These differences are readily accounted for by the relative situation of the cavities. It appears also, from M. Ollivier's observations, that wounds of the right ventricle are not only the most frequent, but of all others they are the most rapidly mortal. It is considered that the suddenness of death in severe wounds of the cavities of this organ, is to be ascribed not merely to the loss of blood, but to the degree of compression which the heart experiences from that which escapes into the bag of the pericardium.

A singular case of accidental wound of the heart, causing death, is reported in the 'Med. Times and Gaz.' for May 12, 1860, p. 467. A woman died suddenly under suspicious circumstances. On inspection, it was found that a large fish-bone had protruded through the stomach and had perforated the heart, causing death by hæmorrhage.

In reference to the direction of penetrating wounds of the chest, it may be proper to state that the base of the heart corresponds to the upper margin of the third rib on the left side; and the apex to the lower margin of the fifth rib on the same side.

Ruptures of the heart.—The heart is liable to be *ruptured* either from disease or accident. In the latter case, the organ generally gives way towards the base, and through one of its cavities on the right side. (For cases, see 'Med.-Chir. Rev.' vol. 31, p. 532.) Dr. Hope asserts that in ruptures from natural causes, it is the left side of the heart, and particularly the left ventricle, in which a rupture is most frequently found. The symptoms are sudden pain, collapse, cramps, cold extremities, and rapid death. According to the circumstances under which they occur, cases of rupture from disease may excite a suspicion of death from violence. Sometimes the substance of the heart appears to have undergone fatty degeneration. Dr. Quain met with a case in which, under this diseased condition, the left ventricle had become ruptured during slight muscular exertion. ('Med. Gaz.' vol. 38, pp. 774 and 857.) Mr. Marshall has reported a case of rupture of the right ventricle under similar circumstances. ('Lancet,' Feb. 16, 1857.) In other instances there has been no apparent alteration of structure. Dr. Stroud reported to the Med.-Chir. Society a case of this kind, which occurred in a young man aged twenty-nine. The deceased died in ten hours after his first seizure; on inspection, there was a small aperture in the right auricle near the vena cava. This did not appear to be connected with any morbid condition of the heart. ('Med. Gaz.' vol. 26, p. 518; 'Lancet,' Nov. 1843.) As a medico-legal subject, it is worthy of note that when this alarming accident proceeds from blows or falls, it is not always accompanied by marks of external violence—or any fracture or other injury to the exterior of the chest. A girl, five years of age, was knocked down and run over by a cart. When brought to the hospital she was quite dead, and there was no mark of injury upon any part of the body. On inspection, the pericardium was found to be full of blood, which had issued from a transverse rent across the apex of the heart. Both ventricles were laid open: the muscular substance was torn to a greater extent than the pericardium. The spine and ribs were unbroken, and there was no injury to any other organ. It was obvious that the injury to the heart had been occasioned by the accident. ('Mem. of Pathological Society,' Jan. 1863.) A case is recorded by Dr. Gairdner, in which a cart-wheel passed over the chest of a child, and occasioned instant death by causing rupture of the heart. Dr. Christison met with two similar instances, one caused by a fall, and the other by a blow. I have been enabled to collect two others, one of which was communicated to me by Dr. Geoghegan, of Dublin. A child was killed, as it was supposed, by the wheel of a carriage going over its chest. On inspection, the skin, muscles, and ribs were entirely free from any marks of injury. The pericardium was lacerated, and a pint of blood was effused into the right pleural cavity. The heart was found ruptured throughout its entire length. In another case, which occurred to Mr. Jeffery, of Sidmouth, a man fell from a cliff the height of one hundred feet. There were a few slight bruises about the body, but no serious wound or fracture. On opening the chest, the pericardium was found to be distended with dark fluid blood, which had escaped from an irregular opening about three quarters of an inch in diameter, situated in the anterior portion of the right auricle. (For another case, see 'Cyc. Pr. Med.' Vol. 4, p. 557.) In the American edition of this work, a case is mentioned by Dr. Griffiths, in which a boy was run over by a heavy wagon, two wheels of which passed over his chest. He arose apparently not much injured, but on reaching the side of the street, fell dead. On dissection, the heart was found ruptured. The ribs were not fractured, nor was there any laceration of the parietes of the thorax (p. 317.)

The *natural* causes of rupture of the heart are violent mental emotions, such as anger, fright, terror, paroxysms of passion, sudden or excessive muscular efforts, or violent physical exertions in constrained positions. The heart, like any other muscle, may also give way from its own powerful contraction. The left auricle of the heart has been ruptured as a mere result of great physical exertion. (See case, 'Med. Gaz.' vol. 47, p. 1063.) Rupture of the heart from any of these natural causes is, however, a rare occurrence. ('Med.-Chir. Rev.' Oct. 1847, p. 460; 'Lancet,' Jan. 23, 1860, p. 88; and Gamgee's 'Pathological Anatomy,' p. 7.)

It is of importance for the medical jurist to be aware that rupture of the heart may prove suddenly and rapidly fatal to life, although the lesion may not involve the cavities. Dr. Maclagan met with the following case:—A lady, æt. 75, was suddenly seized with faintness and occasional fits of hurried respiration: she died in about an hour. On inspection, the pericardium was found to be distended with twelve ounces of blood, one-third of which was in a coagulated state. A fissure was found in the superficial fibres about one-third of an inch in length, over the left ventricle and near the septum. There was another and smaller laceration a little higher up. The larger rent communicated with one of the coronary veins, and from this, and some of the smaller arteries in the substance of the heart, the hæmorrhage had proceeded: the lining membrane of the left ventricle was quite sound. Death had been caused by the mechanical effect of the blood in interrupting the heart's action. (Cormack's 'Monthly Journal,' June 1845, 421.)

When the heart is in a diseased condition, any slight causes of excitement are sufficient to produce rupture and sudden death. The mere exercise of walking may thus give rise to fatal consequences. A case of this kind is reported by Dr. Wharrie, in which a man was found dead upon a high road. The right auricle was found ruptured near the superior vena cava: its substance was thin, soft, and very easily torn. (Cormack's 'Monthly Journal,' May 1846, 343.) The same writer describes a singular case in which a man died suddenly after a struggle with an adversary. No blows had been exchanged. In this instance the walls of the left ventricle were found much thickened, and the aortic valves were ossified: there was no rupture. (Loc cit.)

Wounds of arteries and veins.—Wounds of the large arterial and venous trunks, around the heart, must be considered as decidedly mortal: death is generally instantaneous from the sudden and profuse bleeding which attends them. Dr. Heil, of Bamberg, has related a case which he considers to prove that a person may recover from a penetrating wound of the *ascending aorta.* (Henke's 'Zeitschrift,' 1837, b. 2, s. 459.) With regard to these fatal effusions of blood within the chest, as well as in the other great cavities, it may be proper to mention that, from whatever vessel or vessels the blood may have issued, it is not commonly found coagulated to any extent. The greater part of it generally preserves the liquid state: and it is rare that so much as one-half of the quantity effused is met with in the form of coagulum. These effusions of blood in the chest may be sometimes traced to wounds of the intercostal and the internal mammary arteries, or of the vena azygos.

Wounds of the *carotid arteries* have been fully considered in the section on wounds of the throat (*ante*, pp. 411, 513). Of wounds of the other blood-vessels, whether arteries or veins, it is unnecessary to make any further remark. Death is generally owing to loss of blood, and the bleeding from a comparatively small vessel may prove fatal, according to its situation and the state of the individual.

Death from the entrance of air into wounded veins.—In wounds of *veins* there is an occasional and a peculiar cause of death which requires notice, namely, the entrance of air by the open mouth of the divided vessel. Among many cases of this kind I select one which occurred to Dr. Willis, of Barnes, in March 1848:—A man was labouring under chronic laryngitis, and it was considered proper to introduce a seton at the fore part of the neck. The skin was raised, and the seton-needle was passed horizontally through the skin, about two inches and a half above the breast-bone, and not at all near to the jugular vein or any other important blood-vessel. At the instant of its entrance there was a momentary hissing sound,—the man became pale,—his features were set,—he fainted, and he subsequently became rigid and convulsed. The man did not recover his consciousness, was attacked with lockjaw, and died in seven hours. The medical evidence given at the inquest proved that death had not arisen from loss of blood, but from air penetrating through a small vein which had been accidentally divided. A verdict was returned accordingly. After the inquest the body was inspected, and it was then found that the jugular veins and the large vessels of the neck were uninjured. The right auricle and pulmonary artery were distended with frothy blood, and the lungs were emphysematous, distended with much air. ('Med. Gaz.' vol. 41, p. 608.) For another case of sudden death from this cause, see 'Med. Gaz.' vol. 43, p. 1098. See also a paper on this subject in the same journal by Mr. Lane, vol. 45, p. 926. Dr. Bernard has shown that the air thus introduced into veins does not act by paralyzing and obstructing the action of the heart: the obstacle which it creates to the circulation, is in the lungs. ('Leçons,' p. 163.)

It has been long known that air injected into the jugular vein would destroy life by interfering with the functions of the heart. The exact nature of this accident, as it occurs in operations, is not well understood. (Ferguson's 'Surgery,' p. 444.) According to some, the air rushes into the cavity of the vessel owing to atmospheric pressure during the expansion of the heart, while others believe it to be dependent on the act of inspiration. It is difficult to account for the entrance of air by atmospheric pressure, unless the cut orifice of the vein be kept open, or unless its coats be morbidly thickened, so that it does not readily close when divided; nevertheless, death may thus occur without the slightest imputation on the skill of the operator. Dr. Cormack has shown that in some alleged cases of this kind, death was probably due to loss of blood. When the bleeding is slight, and the hissing sound is heard at the time of the incision, it may fairly be ascribed to the entrance of air. This opinion would be confirmed by the discovery of a frothy state of the blood in the right cavities of the heart. It is worthy of remark, that death may take place from this cause, although a person may recover from the first symptoms. A case has been reported in which a man died under these circumstances in thirteen hours, although he had so far recovered in the interim, that the functions of the lungs and heart were completely restored. ('Association Journal,' Jan. 28, 1853, p. 91.)

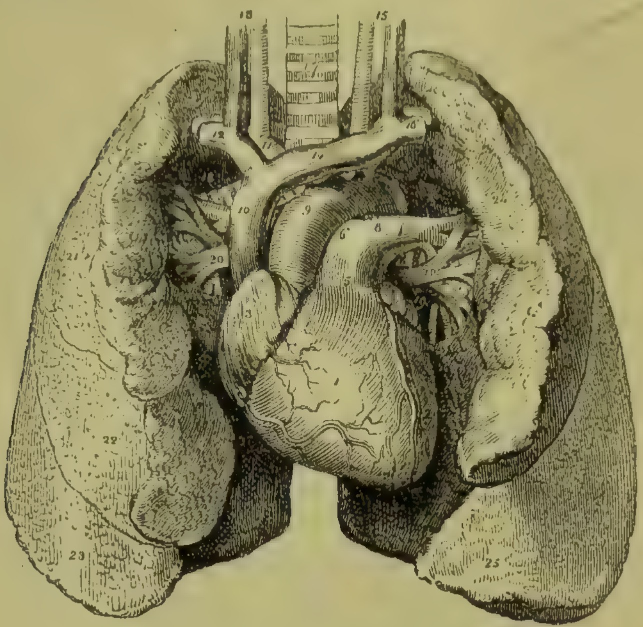
Wounds and ruptures of the diaphragm.—The diaphragm, or muscular partition between the chest and abdomen, is liable to be wounded either by weapons which penetrate the cavity of the chest or abdomen, or by the ribs when fractured by violent blows or falls; but, under any circumstances, wounds of this muscle are not likely to occur without implicating the important organs that are in contact with it. It is scarcely possible, therefore, to estimate the danger of these injuries abstractedly, as the medical opinion must materially depend on the concomitant mischief to the adjoining viscera. Slight penetrating wounds of the diaphragm may heal like those of other muscular parts; and cases of this kind are on record. There is, however, especially when the wound is of a lacerated kind, a consecutive source of mischief which no remedial means can avert,—namely, that after the wound has, to all appearance, healed, the life of a person may be cut short by the strangulation of a portion of the stomach or bowels in the half-cicatrized aperture. An instance reported by Dr. Smith affords an illustration of this. A sharp-pointed weapon had penetrated the diaphragm, notwithstanding which the patient apparently made a rapid and perfect recovery. At the end of about three months, however, the man died from a strangulated hernia or rupture involving the stomach, which had passed through the wound of the diaphragm into the thorax. ('For. Med.' p. 279.) In a case of this description, when death occurs at a long period after the infliction of a wound, the witness may probably be required to say—Whether the wound was the cause of death? or whether there were any other circumstances which would have caused or facilitated the production of a hernia. The degree of culpability of an aggressor may materially depend upon the answers returned to these questions. *Phrenic hernia*, as this form of internal rupture is termed, is not by any means an unusual or unexpected fatal consequence of a wound of the diaphragm; and therefore it would appear, at first sight, that death, at whatever period this event may occur, should be referred to the original wound. But the case may present some difficulties, as it is possible that a slight blow on the stomach, received subsequently to the wound, or even any violent exertion on the part of the deceased, might have produced fatal strangulation. A person may survive with a large phrenic hernia for a considerable period, and die from some other cause. A case of this kind has already been related, in which the stomach and part of the intestines were found in the left cavity of the chest, and the person lived for nine months (*ante*, p. 514). The fact of a person surviving will, however, depend on the freedom of communication between the chest and the abdomen. If the aperture is small and unyielding, strangulation may occur, followed by death within the usual period of time. Dr. A. T. Thomson has related an interesting case of this kind. A man fractured two of his ribs by a fall. It was not until twelve months afterwards, that he was admitted into University College Hospital, where he died two days after his admission. On inspection, it was found that about fourteen inches of the colon protruded into the chest through an aperture in the diaphragm, so small as only to admit the point of a finger. The intestine had become strangulated, and this had led to death. There was no doubt that the injury to the diaphragm had been occasioned by the same accident which had caused the fracture of the ribs. The hernia, judging from the symptoms, had taken place only a few days before death. ('Med. Gaz.' Vol. 40, p. 584.) Another case has been elsewhere related (p. 479) in which a man, who was stabbed in a quarrel, died from phrenic hernia fifteen months afterwards. These two cases are of importance, inasmuch as they show that death may unexpectedly occur from the effects of an injury to the chest received a long time previously. They also prove the absurdity of that principle of the English law which makes the aggressor responsible for a fatal result only when the death happens within a year and a day after the receipt of a wound. If a person is exculpated when death takes place after fifteen months, in spite of the clearest evidence that violence was the moving cause, then there is no reason why persons should not be equally discharged from responsibility, when the wounded person survives ten, five, or even two months. The reader will find some important remarks on phrenic hernia and its fatality in Dr. Reid's 'Physiological Researches,' p. 521.

The most serious injuries to the diaphragm are unquestionably those which are produced by violent contusions or falls on the abdomen, at a time when the stomach and intestines are distended. In these cases the muscular fibres may be ruptured to a greater or less extent: but the bleeding is not considerable, rarely exceeding two, three, or four ounces. A uniform result of these *ruptures*, when extensive, is a protrusion of the stomach into the chest, with sometimes a rupture of the coats of this organ and extravasation of its contents. Severe lacerations of the diaphragm are more readily produced during the act of inspiration than during expiration—the fibres of the muscle being then stretched, and receiving, while in this state of tension, the whole of the force. According to Devergie, the rupture most frequently takes place in the central tendinous structure, where it is united with the left muscular portion above the crura. He has remarked that it occurs more commonly on the left side than on the right. (Op. cit. vol. 2, p. 250.) It has been supposed that death was an immediate consequence of this accident; but this view is not supported by facts. In a case of extensive rupture of the diaphragm, related by Devergie, in which the stomach and colon were found in the chest, the person lived nine months after the only accident which could have produced it, and then died from another cause. Besides the stomach, it sometimes happens that the liver, spleen, or intestines pass through the opening, and, like it, these organs are liable to become strangulated: the lungs are at the same time so compressed that respiration is stopped, and asphyxia or suffocation may be an immediate result.

Direction of wounds in the chest.—In judging of the *direction* taken by wounds which traverse the chest from front to back, it is necessary to remember the great difference that exists in the level of the same rib anteriorly and posteriorly. This must be especially attended to when we are called upon to state the direction of a traversing wound from the description of it given by another. The point here referred to had an important bearing in the case of a fatal gunshot wound, which was the subject of a criminal charge some years since. (Henke's 'Zeitschrift,' 1836.)

A person died from a single pellet of small-shot traversing the chest from before backwards. The pellet entered between the first and second ribs anteriorly, and traversing the lung, caused death by lacerating the sixth intercostal artery, near its origin at the lower edge of the sixth rib, posteriorly. In giving an opinion on the direction of this wound, a fact which happened to be important in regard to the position of the assailant, one medical witness, from not duly considering the sloping of the ribs from behind forwards, described the wound behind as being six inches below the level of that in front. As the small canal through the lungs could not be discovered, he was inclined to think that the two wounds could not be connected, because the gun had been discharged from the shoulder when the party firing was nearly on a level with the deceased. This opinion, however, was soon corrected by a reference to the anatomical relations of the parietes of the thorax. Indeed, it will be found, that a straight line carried backwards from between the first and second ribs in front will, in a well-formed skeleton, touch the upper border of the fifth rib posteriorly; therefore this wound was nearly *horizontal*— being only one inch and a quarter lower posteriorly, than anteriorly. In the case of Colonel *Fawcett*, killed in a duel, the bullet entered on the right side of the chest, fracturing the *seventh* rib, and after traversing the posterior part of the lungs, lodged in the *ninth* dorsal vertebra. These parts are in a line with each other, and the wound was horizontal. It must not be forgotten that a wound immediately below the chest bone, will in its fore part involve the viscera of the abdomen, — in the back part those of the chest, and in its central part it will traverse the diaphragm.

For the better understanding of medical evidence in reference to wounds of the chest, an engraving is annexed, which represents the relative position of the lungs, heart, and blood-vessels. The ribs and diaphragm are removed.



Front view of the Viscera of the Chest.

1. Right ventricle of the heart. 2. Left ventricle. 3. Right auricle. 4. Left auricle. 5. Pulmonary artery. 6. Right pulmonary artery. 7. Left pulmonary artery. 8. Ligament of the ductus arteriosus. 9. Arch of the aorta. 10. Superior vena cava. 11. Arteria innominata, and in front of it the right vena innominata. 12. Right subclavian vein, and, behind it, its corresponding artery. 13. Right common carotid artery and vein. 14. Left vena innominata. 15. Left carotid artery and vein. 16. Left subclavian vein and artery. 17. Trachea, or windpipe. 18. Right bronchus. 19. Left bronchus. 20, 20. Pulmonary veins; 18, 20, form the root of the right lung; and 7, 19, 20, the root of the left. 21. Superior lobe of the right lung. 22. Middle lobe. 23. Inferior lobe. 24. Superior lobe of the left lung. 25. Inferior lobe.

The heart is here represented without the pericardium, the membranous covering or bag in which it is contained.

Wounds of the parietes of the Abdomen.—Incised and punctured wounds, which affect the parietes or coverings of the abdomen, without penetrating the cavity, are not quite of so simple a nature as might at first sight be imagined. The danger is immediate if the epigastric artery be wounded; for a fatal hæmorrhage will, in some instances, take place from a wound of this small vessel. In a case which occurred to Dr. Colles, of Dublin, a carpenter who had a chisel in his pocket stumbled in walking, and received a wound in the abdomen with the edge of the tool. When brought to the hospital, the man appeared exhausted from loss of blood,—the skin was cold and pallid; he gradually became weaker, the pulse imperceptible, and he died a few hours after his admission. On an examination of the body, the epigastric artery was found divided, and the cavity of the peritoneum distended with blood. It is true, that in this case, the abdomen was penetrated; but the real cause of death was the blood lost from the wounded artery. Mr. Travers mentions, that a man was brought to St. Thomas's Hospital, who had been stabbed in the direction of the epigastric artery on the left side of the abdomen, with a case-knife. He died in eighteen hours, apparently owing to bleeding from this vessel. Among the other sources of danger from these superficial wounds, is inflammation, followed by suppuration beneath the tendinous membrane which covers the abdominal muscles. The matter formed is very liable to accumulate within the sheath of the muscles, and this may prove fatal unless proper treatment be adopted. The inflammation will sometimes extend to the peritoneum, and thus rapidly destroy life. As improper medical treatment may, in either of these cases, cause a superficial wound of the abdomen to take a fatal termination,—so when a person stands charged with having inflicted such a wound, it will be necessary for a medical witness to consider how far the consequences of the act of the prisoner have been aggravated by negligence or unskilfulness. But when these wounds take a favourable course and heal, there is an after-effect to be dreaded, namely, a protrusion of the viscera at the cicatrized spot, constituting ventral hernia. When the wound has involved the muscular fibres transversely to their course, the cicatrix which follows, is commonly far less capable of resisting the pressure of the viscera within, than other parts of the parietes. A hernia may take place, and this, like other herniæ, if neglected, is liable to become strangulated and lead to the destruction of life. The walls of the abdomen, owing to the protrusion of this cavity, are easily penetrated by pointed instruments, and it requires but a slight force to traverse them completely and wound the intestines. A slight wound may thus prove fatal by leading to peritoneal inflammation. In July 1861, a Mrs. *Cuthrey* died from the effects of a penetrating wound, produced by a table-knife being thrown across a dinner-table at her. The point of the knife penetrated the abdomen for about three-quarters of an inch. The deceased died from peritonitis. There was a slight opening in the small intestine.

Contusions are attended generally with far more serious effects on the cavity of the abdomen than on the chest. This arises from the coverings of the abdomen having less power to resist external shocks. In the first place, death may be the immediate result of a blow in the upper and central portions; no particular morbid changes may be apparent on inspection, and the violence may have been so slight as not to have produced any ecchymosed mark on the skin. Death has been ascribed in these cases to a fatal shock transmitted to the system through a violent impression produced on the nerve-centre—called the solar plexus. Some remarks have already been made on sudden death from blows on this part of the abdomen (see p. 470). Travers, Alison, Watson, Cooper, and other writers on surgical injuries, have referred to cases of this kind as of not unfrequent occurrence. They are of considerable importance in a medico-legal view, as, in the absence of marks of physical injury in the part struck, a jury might be led to doubt whether the blow could have been the cause of death. In *Rex* v. *Jones* (Warwick Summer Assizes, 1831)—a case of alleged manslaughter—prisoner was charged with having struck deceased several blows on the breast, and one on the pit of the stomach, by which he instantly fell down senseless and expired. On dissection no morbid appearances were found. The prisoner was convicted. ('Watson on Homicide,' p. 75.) In another case, tried at the Central Criminal Court in Aug. 1841 (*The Queen* against *Sayers*), death was thus caused by violence during a pugilistic combat. A man received a blow in the stomach, and fell dead. As there were no marks of external injury, the surgeon thought the deceased had died of apoplexy! The prisoner was acquitted. A similar case was the subject of a trial at the Norwich Lent Assizes, 1854 (*Reg* v. *Laws*). The deceased, a powerful man, received during a pugilistic encounter a blow on the abdomen, and he instantly fell backwards, dead. On an examination of the body there were no marks of injury, either externally or internally. The surgeon attributed death to sudden shock; and this, no doubt, was the true cause. The learned judge left it to the jury to say whether they thought the death of the deceased was caused by a blow; but if they could not say what was the cause of death, or if they should think that death was attributable to excitement and that it was independent of the blow, the prisoner would be entitled to an acquittal. A verdict of Not Guilty was returned. Although the blow was seen to be struck, and was a sufficient cause of death under the circumstances, the jury probably thought that there should be some *visible* injury to the body; and, in the absence of this, declined to refer death to the violence. Had the jury possessed any medical experience or knowledge of the causes of death from violence, they would have seen their way through this apparent difficulty. Some surgeons have thought that these cases have not been accurately observed, and that in those which terminate fatally, a more careful inspection would probably have shown visible changes in the organic structures. The fact, however, remains: persons have died soon after receiving severe blows on the upper part of the abdomen, and the medical men who have examined the bodies for the express purpose of detecting physical injuries, have not found any to record. Moreover they have not found in any part of the body a natural cause of sudden death.

Blows on the abdomen, when they do not destroy life by shock, may cause death by inducing peritoneal inflammation. Several cases of this kind are mentioned by Mr. Watson ('On Homicide,' 186), and more than one has been tried of late years where violence to the abdomen was proved, but no mechanical lesion had been produced: the wounded person, however, died from peritonitis in the course of a few days. (*The Queen* against *Martin*, Cent. Crim. Court, 1839.) For two other medico-legal cases by Dr. Wharrie, in which death arose from this cause see 'Cormack's Monthly Journal,' May 1846, p. 340. Peritonitis thus induced, is apt to be accompanied by inflammation of serous membranes in other cavities: thus, it is said, a person may be cut off by pleurisy depending on an attack of peritonitis, produced by violence, while the former disease would probably be referred to some other cause. In a case which occurred a few years since, a woman received some severe blows on the abdomen from her husband. She died in five days. There were marks of pleurisy and peritonitis on dissection, the former much more decided. The medical witness, while he allowed that the peritonitis might have been caused by blows, thought that death had been produced by an attack of pleurisy from cold. The jury acquitted the husband. The reporter of the case considers that the attack of pleurisy was immediately dependent on the peritoneal inflammation produced by the violence. (See 'Med. Gaz.' vol. 25, p. 13.) This doctrine requires confirmation, before it can be safely applied to medico-legal practice. Such a sympathetic connexion between the two diseases must not only be rendered probable, but actually proved. Peritonitis thus produced by violence to the abdomen, is not always fatal. ('Lancet,' Jan. 24, 1846, p. 104; also 'Med. Gaz.' vol. 37, p. 460.) Among other instructive cases of this kind, is one recorded by Dr. Allen, in which fatal peritonitis followed a slight amount of violence. (See 'Lancet,' Jan. 5, 1850, p. 29.) I was present at a trial at the Swansea Lent Assizes, 1863, in which a man was convicted of manslaughter, by giving to the deceased a kick in the lower part of the abdomen. No organ was ruptured, but peritonitis was set up, and death took place in two or three days. Mr. Neill met with the following case:—A soldier, during an action, was struck by a spent ball, on the abdomen, over the region of the bladder. The ball fell on the ground at his feet, without either injuring his clothes or even marking his skin. He did not feel much pain at the time, and walked to the hospital, a distance of two miles, with the ball in his pocket, but he died shortly afterwards from peritonitis and inflammation of the bladder. The entire surface of the abdomen presented the appearance of a severe bruise, in a few hours after he was struck. (Ed. 'Med. Jour.' March 1863, p. 793.) Violence applied to the abdomen is not however always indicated by ecchymosis or injury to the skin. Effusions of blood in the sheaths or tendinous coverings of the muscles, may or may not be indicative of violence. One fact must here be borne in mind, to prevent mistakes in examining a body after death, namely, that blood may be found copiously effused in and around the abdominal muscles, quite irrespective of the application of violence. Dr.

John Reid states that he has met with four cases of this description in about five hundred inspections made at the Royal Infirmary. A man, æt. 39, died of disease of the kidneys four weeks after his admission to the hospital. On inspection, a considerable quantity of dark coagulated blood was found effused in the (*recti*) muscles of the abdomen around the navel, without any external appearance to indicate its presence. A man, æt. 40, died of fever three days after his admission. On inspection, twenty-four hours after death, a large quantity of dark-coloured coagulated blood was found in the muscles round the navel. The skin had its natural appearance. In two other cases the effusions were in and around the muscles of the chest. ('Physiological Researches,' p. 511.)

The absence of ecchymosis, or abrasion of the skin, is sufficient to show that such extensive effusions are not caused by violence. Blows adequate to produce this laceration of the vessels and hæmorrhage, would most probably be attended with ecchymosis—and some visible injury to the skin. At any rate when such marks of violence are not visible, and there is no evidence of a blow having been struck, a witness would act wisely in declining to attribute the mere effusion of blood to the act of another person.

Deeply penetrating wounds of the abdomen are generally fatal by reason of the injury done to the intestines and other organs. In a remarkable case recorded by Mr. Todd, a soldier by accident so fell upon his bayonet, that although the weapon traversed the whole cavity of the abdomen (entering at the back and coming out in front below the navel), the man recovered in about six weeks. ('Med. Times and Gaz.,' March 30, 1861, p. 329.) This case is of importance in reference to the situation and direction of wounds (p. 545). Had there been no knowledge of the facts, this accidental wound might have been pronounced homicidal.

Ruptures of the liver.—Blows on the abdomen may prove fatal by causing a rupture of the liver or other viscera, with extravasation of blood: and as it has been elsewhere stated (p. 393), these serious injuries may occur without being attended with any marks of external violence. Of all the internal organs, the liver and spleen are the most exposed to rupture, owing to their compact structure, which prevents them from yielding to a sudden shock, like the stomach and intestines. Ruptures of the liver may occur from falls or blows; but this organ may be ruptured merely by a sudden action of the abdominal muscles. An accident of this kind happened to a person who was endeavouring to avoid a fall from his horse. ('Male's Jur. Med.' p. 119.) A fall on the feet from an elevated spot may also produce laceration of this organ. ('Ann. d'Hyg.' 1846, t. 1, p. 133.) Ruptures of the liver are generally seen on the convex surface and anterior margin, seldom extending through the whole substance of the organ, but consisting of fissures, varying from one to two inches in depth. The right lobe from its size is more usually affected than the left. Their usual direction is from before backwards, with a slight obliquity; they rarely intersect the liver transversely. The lacerated edges are not much separated, while the surfaces present a granular appearance. But little blood is met with in the laceration; it is commonly found effused in the lower part of the cavity of the peritoneum, or in the hollow of the pelvis, and is only in part coagulated. Ruptures of the liver, unless they run far backwards and involve the vena cava or portal vein, are not in general attended with any considerable effusion of blood; but the bleeding, should this vessel be implicated, is sufficient to cause the instant destruction of life. Under other circumstances, a person may survive some hours, as the blood may escape only slowly, or it may be suddenly effused in fatal quantity after some hours or days, as a result of violent exertion or of fresh violence applied to the abdomen. A man came into Guy's Hospital some years since, in whom there were no immediate or urgent symptoms. He was sent away, and a few hours afterwards was found dead in a cell at a police-station. On inspection, the liver was lacerated nearly through its diameter, and as much as a basinful of blood was found in the cavity of the abdomen. ('Med. Times and Gaz.,' 1864, vol. 2, p. 527.) This effusion must have taken place after the man had left the hospital. On the other hand death may be a slow result of this injury. In one case, a man is reported to have died from a rupture of the liver, which had occurred from an accident eight days before. ('Med. Chir. Rev.,' Jan. 1836, p. 296.)

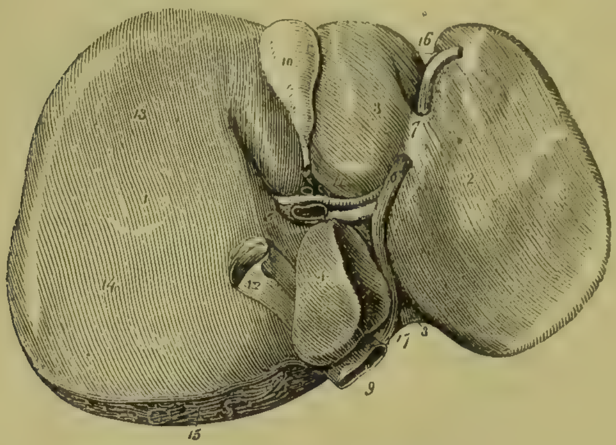
In June 1841 a drunken man was admitted into Guy's Hospital. There was no mark of violence about him—but he appeared helpless from intoxication. He died in about nine hours, and on inspection two quarts of blood were found effused in the abdomen. This had flowed from a large rupture in the right lobe of the liver. It had probably escaped slowly, for the man was able to move about just before he died. Another case was admitted into Guy's Hospital in 1861. There was extensive laceration of the liver, but there were no symptoms of this severe injury, and its existence was not even suspected until the man died suddenly on the day after his admission. Other instances are reported by Dr. Wharrie ('Cormack's Journal,' May 1846, p. 341.) Dr. Miller, of Launceston, Tasmania, has communicated to me a case of extensive rupture of the liver as well as of the diaphragm, which fell under his notice in January 1862. A man, who had been in good health half an hour before, was found dead upon the high-road, and there was reason to believe that he had been run over by his own dray. The abdomen was found full of effused blood, which had proceeded from a large rupture on the under surface of the right lobe of the liver. It was T-shaped, five inches in the transverse, and about two inches in the longitudinal direction. The diaphragm was ruptured on the right side for about four inches from before backwards, and the liver protruded through the aperture into the chest. On opening the head, about two tablespoonfuls of blood were found effused between the membranes; and the substance of the brain was unhealthy. In this case Dr. Miller could find no marks of external violence. There was not the slightest scratch, abrasion, or discolouration of the skin, but the sixth and seventh ribs were broken transversely near their sternal extremities. From the state of the brain it was thought probable that the man had had an apoplectic seizure, and had fallen under the wheel of the dray.

Ruptures of the liver generally prove fatal within forty-eight hours. One case has been related in which the person survived for eight days; and a case occurred to Dr. Wilks in which a person in Guy's Hospital survived this serious accident ten days. On inspection, it was found that the diaphragm had been ruptured as well as the liver, and that the two had united, an abscess having been formed between them. The liver had been lacerated on its right side. ('Lancet,' 1864, Dec. 24, p. 716.) Ruptures of this organ may take place from violence applied to the *chest*, and there may be no marks of injury to the region of the liver. (See case, 'Med. Times,' Aug. 30, 1851, p. 234. For other cases, see 'Med. Gaz.' vol. 47, p. 156.) Mr. Partridge lately presented to the Pathological Society the liver of a boy who had been run over by a cart. He died almost immediately from loss of blood. There was no external bruising. ('Lancet,' Jan. 21, 1860.) In *Regina* v. *Cuffery* (Liverpool Winter Assizes, 1863), on which I was consulted, a new question presented itself in reference to these ruptures, namely, the time required for the effusion of a large quantity of blood into the abdomen when none of the large vessels are involved in the laceration. A police-constable was charged with having caused the death of a man. The deceased was drunk, had fallen three times, and had been kicked and maltreated by a mob. The prisoner took or dragged him to the station, and in an attempt to escape, he knocked down the deceased and fell on him, his knee striking the abdomen. The deceased appeared to suffer great pain when he was lifted up, but he was able to walk to the station with assistance: when there he soon became insensible, breathed heavily, and died in a quarter of an hour or twenty minutes afterwards. On inspection, the liver was found to be ruptured in three places, but none of the large blood-vessels were involved. Upwards of three pints of blood were effused in the abdomen, and the medical witnesses agreed that death was owing to internal hæmorrhage as a result of the ruptures. The question, however, arose whether the ruptures were caused by the violence of the prisoner about twenty minutes before death—or by any of the falls and ill-treatment which the deceased had previously sustained. It was contended in favour of the prisoner, that so large a quantity of blood could not be effused in so short a period as a quarter of an hour or twenty minutes, when the rupture involved only the substance of the liver, and not the large blood-vessels. Hence it was alleged the rupture must have been caused by the previous violence. One medical witness thought it possible that this quantity of blood might have escaped from the smaller vessels within the time mentioned,—another thought that it would have taken at least half an hour for such an extensive effusion to be produced. The jury acquitted the prisoner.

The question here raised was based on too refined a speculation for a satisfactory answer, and it is not surprising that the witnesses differed. The violence received before the prisoner took the deceased into custody, was admitted to be quite sufficient to account for the ruptures of the liver and the fatal hæmorrhage, and there was nothing to fix it on the act of the prisoner. We have no means of measuring the rapidity with which blood flows on these occasions. A large number of small vessels will pour out as much blood as one or two large vessels. It is stated that the liver was ruptured in three places, hence an extensive bleeding surface must have been exposed. The man was able to walk after the violence, and this exertion may have added to the hæmorrhage. Lastly, the bleeding would probably continue after death, so long as the blood retained its warmth and fluidity. The prisoner was very properly acquitted, not because the amount of effusion was inconsistent with the time assigned, but because there was a failure of evidence to show that the rupture was caused by his violence. Assuming that the rupture existed when the deceased was struck by the prisoner, it might have been a question whether his violence had not accelerated death by increasing the hæmorrhage.

Wounds of the gall-bladder.—Wounds and ruptures of the gall-bladder are necessarily attended with the effusion of bile. This irritant fluid finds its way into the cavity of the abdomen, and the person dies from peritonitis. A fatal case of this description occurred to Dr. Maclachlan. An old man while getting out of bed fell with great violence on the floor. He died from peritonitis in forty-eight hours. The gall-bladder was ruptured, and a large stone was found impacted in the cystic duct. ('Med. Gaz.' vol. 37, p. 968.)

For the better comprehension of medical evidence in reference to ruptures and wounds of the liver and gall-bladder, an engraving is annexed (p. 552) representing the under surface of the liver with the relative position of the larger blood-vessels. 1. The right or large lobe. 2. The left lobe. 3. The lobus quadratus, so named from its shape. 4. The lobus Spigelii. 5. The lobus caudatus. 6. The longitudinal fissure; the numeral is placed on the rounded cord, the remains of the umbilical vein. 7. The pons hepatis. 8. The fissure of the ductus or canabis venosus. The obliterated cord of the duct is seen passing backwards to be attached to the coats of the inferior vena cava (9). 10. the gall-bladder with its widest part or fundus projecting slightly beyond the anterior margin. 11. The transverse fissure containing from before backwards the hepatic duct, the hepatic artery, and the portal vein. 12. The vena cava. 13, 14. Depressions produced by viscera covered by the liver. 15. The posterior border of the liver. The notch 17 corresponding with the spine. 16. The notch in the anterior border separating the two lobes. It is in this border that ruptures most commonly take place, and in the edge of the right or large lobe.



View of the under surface of the Liver.

Rupture of the spleen.—Ruptures of the spleen may occur either from violence or disease, and it would appear from the following case, reported by Mr. Heddle ('Med.-Chir. Rev.' Oct. 1839), that a slight degree of violence is sufficient to rupture this organ, while there may be no marks of injury externally. A middle-aged man was observed fighting with a boy about fourteen years of age, who in stature scarcely reached to his waist. When the fight had terminated the boy ran away: the deceased was observed to become weak and faint, and he complained of uneasiness in his left side. He expired a few minutes afterwards. On inspection, no marks of violence could be detected externally; but the cavity of the abdomen contained a large quantity of blood. The spleen was found enlarged, and so softened, that its structure was broken down by the slightest pressure. There was a laceration across its surface, about half an inch in depth, from which the fatal bleeding had proceeded. A similar case, in which death occurred in fifteen minutes, is reported in the 'Medical Gazette,' vol. 35, p. 942. The rupture was caused by a blow, but there was no mark externally to indicate that a blow had been struck. A case of spontaneous rupture of the spleen, which was enlarged and in a diseased condition, is reported in the same journal for June 1842. Dr. Easton communicated to me a case (Feb. 1856) in which a little girl died in fourteen hours from rupture of the spleen. The rupture had arisen from the wheel of a cart passing over her body. There was no mark of external violence. It is highly probable, that when the liver and spleen are ruptured from slight causes, the structure of these organs will be found to be in a diseased condition—a circumstance which may in some cases be regarded as mitigatory of the act of an assailant. (See 'Med. Gaz.' vol. 35. p. 942.) A man, æt. 24, was admitted into Guy's Hospital, in November 1864. He had fallen from a mast-head, twenty-five feet in height, and it was thought that he had fallen on his back. He was rowed ashore and walked to the hospital, where he arrived about an hour after the accident. He died in a quarter of an hour, apparently from internal hæmorrhage. On inspection, there were no external signs of injury. The abdomen contained several pints of blood. The spleen was torn transversely through its middle, and the splenic vein was lacerated in a longitudinal direction. This organ was about twice its natural size, and soft. It had the appearance of a large ague spleen. ('Lancet,' Dec. 24, 1864, p. 716.) The exertion of walking probably led to the fatal effusion and accelerated death.

Rupture of the kidneys.—The *kidneys* are occasionally ruptured from violence; but this appears to be a rare accident. Two cases were reported by Mr. Stanley to the Med.-Chir. Soc. ('Lancet,' Nov. 1843.) In one, the person recovered; in the other, death did not take place for a considerable time. Another case, which occurred in 1847, has been communicated to me by Dr. Beveridge. The injury occurred during a scuffle—its existence was not suspected during life. A rupture of the kidney may be produced without any prominent symptoms, and cause death in a few hours. A man, æt. 60, who had been run over by a light cart, was brought to Guy's Hospital, in November 1864. He walked to the house of a friend at a short distance, and came with him to the hospital in a cab. It was found that three ribs were fractured, but there was no urgent symptom or sign of collapse. He was treated for fractured ribs, and then walked home with his friend and went to bed. Between five and six hours after the accident he was observed to sit up in bed and suddenly fall back dead. On inspection, Mr. Puzey found no bruise or wound of any kind on the injured side. There was a large quantity of fluid and coagulated blood in the abdomen. This had evidently proceeded from the right kidney, which was torn in half transversely through the pelvis. The ninth, tenth, and eleventh ribs were fractured. It is probable that the blood had escaped slowly from the ruptured organ. The case proves that a kidney may be torn in halves and yet the person possess a power of locomotion and muscular exertion.

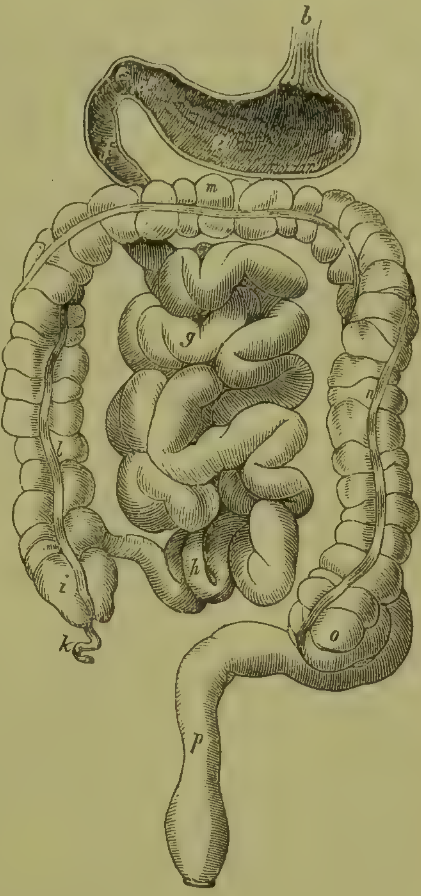
Ruptures and wounds of the intestines.—Ruptures of the intestines sometimes occur from disease; and, in a case of rupture alleged to have been produced by violence, we must always take this possible objection into account. The ruptured part of the bowel should be carefully examined, in order to see whether there are any signs of ulceration or softening about it. If not, and there is clear evidence of violence having been used, it is impossible to admit this speculative objection. If with the proof of violence there should also be a diseased condition of the bowel, we may be required to say whether this did not create a greater liability to rupture—a point which must be admitted. For medico-legal cases of ruptured intestines, see 'Watson on Homicide,' p. 159; Henke's 'Zeitschrift der S. A.,' 1836, 'Erg. H.,' vol. 22, and 'Brit. and For. Rev.' vol. 4, p. 519.) The intestines may be ruptured by an accidental fall. ('Med. Times and Gaz.,' April 13, 1861, p. 403.) Rupture of the intestines may sometimes occur from very slight causes. Any force, as a smart shock *suddenly* applied to the abdomen, will sometimes suffice to cause it. A case has already been related where the blow of a pebble ruptured the jejunum of a young girl by striking the abdomen. A case is reported by Mr. Newton, in which there was no doubt that the ileum had been ruptured by a kick on the abdomen, leading to death by peritonitis. The coroner and jury appear to have thought that as there was no mark of contusion or ecchymosis on the abdomen, the blow could not have been the cause of the mischief (see *ante*, page 393); hence they came to a verdict that the deceased had died from inflammation of the bowels depending on some unknown causes! ('Lancet,' Aug. 9, 1846, p. 15.) It is worthy of remark, that a rupture of the intestines does not necessarily deprive a person of the power of locomotion. Mr. Collier has reported the case of a boy, aged thirteen, whose duodenum was completely ruptured across by a blow: he walked a mile with but little assistance, but he died in thirteen hours. (See 'Med. Gaz.' vol. 12, p. 766.) That rupture of the intestines is not incompatible with the power of locomotion is also proved by a case related by Mr. Ellis, of Dublin, where the cæcum was ruptured; the man was able to walk after the accident, but he died in twenty-four hours. Other instances of this kind are reported by Henke. The ileum is observed to be most liable to rupture from accident. In 1861 a man was brought into Guy's Hospital. He was able to walk to his bed, and he did not appear to be seriously injured, although it was stated that a bale of wool had fallen on him. In the evening he became collapsed, and he died twelve hours after his admission. On inspection, about a pound of blood was effused in the abdomen, and a portion of the ileum was found lacerated—the laceration extending into the mesentery and including the blood-vessels. The laceration was about an inch and a half long, and the bowel was divided not quite through. The intestines were much matted together by lymph and blood, the result of peritoneal inflammation. There had been only slight extravasation of the contents. ('Med. Times and Gaz.,' Sept. 1861.) I am indebted to Dr. Croker King for a report of two fatal cases of ruptured jejunum, one arising from a kick on the abdomen and the other from an accidental fall. Dr. King has observed that persons who have sustained this injury retain the power of locomotion and muscular exertion.

Punctured wounds, which merely touch the bowels without laying open the cavity, are liable to cause death by peritonitis. These injuries to the intestines sometimes destroy life by shock; there is but little blood effused, and the wounded person dies before peritonitis can be set up. Severe wounds to the intestines may, however, be inflicted almost without the consciousness of the individual, and the wounded person may be able to walk a considerable distance. ('Med. Gaz.,' vol. 46, p. 24.)

Wounds and ruptures of the stomach.—Wounds and ruptures of the stomach may cause death by shock: ruptures commonly give rise to severe pain, which of itself is sufficient to bring about rapid dissolution. It is proper to state, however, that the stomach may be ruptured from spontaneous causes, as in cases of ulceration as a result of disease; but sometimes there is no morbid cause apparent. In April 1828 a man, aged thirty-four, was brought into St. Bartholomew's Hospital, complaining of severe pain in the abdomen. Ten hours afterwards he was seized with violent vomiting, the pain ceased, the vomiting also ceased, and he died in five hours more. The posterior surface of the stomach was found lacerated to the extent of three inches, and its contents had escaped through the aperture: the mucous membrane was reddened, but there was no thickening, ulceration, or any apparent disease. ('Med. Gaz.,' vol. 2, p. 182: also 'Dub. Med. Jour.,' May 1845; and 'Ed. Med. and Surg. Jour.,' Oct. 1845, p. 522.) A similar case occurred to Mr. Allen. A boy, æt. ten, had great pain in the abdomen, which was much swollen, and he died in a few hours, in a state of collapse. After death, the cardiac extremity of the stomach, which was softened, but not otherwise diseased, was found ruptured. ('Lancet,' Jan. 3, 1846, 15.) A case, somewhat similar to this in its pathological features, is recorded by Signor Morici. A man, aged thirty, labouring under intermittent fever, died suddenly, after having been to the water-closet. On inspection, the stomach was found ruptured on its anterior surface, to the extent of about two inches, and the contents had escaped into the abdomen. There was no softening or morbid change in the coats, with the exception that the mucous membrane was dotted with redness for a slight distance around the aperture. ('Phil. Med. Examiner,' Nov. 1845, p. 695.) It is obvious, that in alleged lacerations from violence, this liability to spontaneous rupture must not be forgotten. Penetrating wounds of the stomach generally prove rapidly mortal; they seldom form a subject for medico-legal investigation. A singular case was tried at the Norwich Assizes in 1832, in which a man was charged with the murder of his wife, by throwing at her a red-hot poker. The weapon completely perforated her stomach, and the woman died in six hours. It might be a question whether this was a *wound* in the common sense of the term—it was an injury compounded of a burn, puncture, and laceration.

The annexed illustration, Fig. 1, represents the stomach, and the small and large intestines. The stomach is seen in section, with its cavity laid open. *a.* The stomach. *b.* The œsophagus, or gullet, opening into *c*, the cardiac, or larger end of the stomach (on the left of the body.) *d.* The pyloric intestinal, or right end of the stomach. *e.* The situation of the pylorus, or valve which separates the cavity of the stomach from that of the intestines. *f.* The duodenum, or first portion of the small intestines. *g.* The convolutions of the jejunum, or second portion of the small intestines. *h.* The convolutions of the ileum, or the third and lowest portion of the small intestines. *i.* The cæcum, or blind-bowel, the first portion of the large intestines. *k.* The appendix vermiformis of the cæcum. *l m n.* The ascending transverse and descending colon, the second portion of the large intestines. *o.* The sigmoid flexure of the descending colon. *p.* The rectum, or straight bowel, the third and last portion of the large intestines.

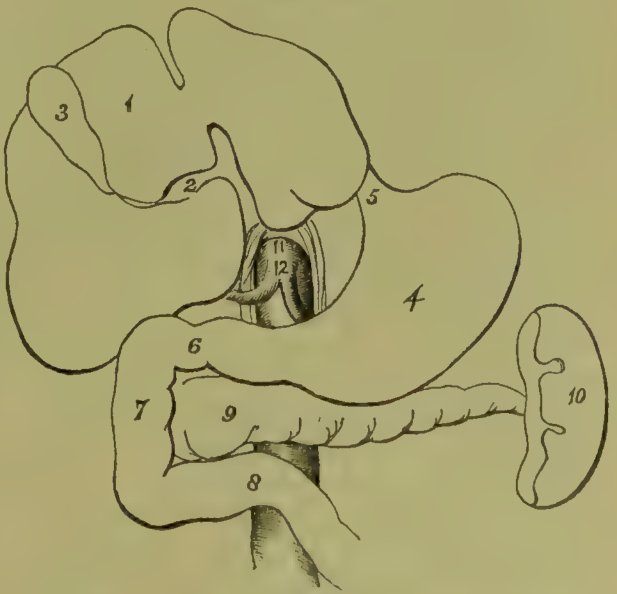
Fig. 1.



The stomach and intestines.

Fig. 2 represents, in outline, the stomach and duodenum, with the liver, spleen, and pancreas. 1. The liver, of which the under surface is here seen, is raised and turned back, so as to expose the other viscera covered by it. It is divided into two unequal parts by a longitudinal fissure—seen in the upper margin—the right or large lobe being on the left of the engraving, and the left or small lobe being on the right. 2. The transverse fissure of the liver. 3. The gall-bladder, of a pyriform shape, of which the neck is towards the centre of the liver and the thickest part or fundus is towards the anterior margin. 4. Represents the stomach. 5. The entrance of the gullet or œsophagus—the cardiac opening; and 6. The situation of the pylorus, or intestinal opening. 7 8. The duodenum, or first part of the small intestines, in its descending and transverse portions. 9. The pancreas. 10. The spleen. 11. and 12. The aorta.

Fig. 2.



The liver, stomach, and duodenum in their relative position.

Ruptures of the bladder.—This injury, which has on several occasions given rise to medico-legal discussion, is frequently the result of blows on the lower part of the abdomen. The principal questions in reference to the accident are:—Was the rupture the result of wilful violence or of an accidental fall?—or, Did it proceed from spontaneous causes, as from over-distension? The spot in which rupture commonly takes place is in the upper and back part, where the bladder is covered by the peritoneum. The aperture is sometimes large, at others small; but the effect is that the urine is effused, and death takes place sooner or later from peritoneal inflammation. It is commonly stated that ruptures, when attended with extravasation of urine into the peritoneal cavity, are uniformly fatal; but if the rupture occurs in the under part of the bladder, or the urine finds its way into the cellular tissue, the medical opinion is not so unfavourable. Mr. Syme has reported a case of recovery under these circumstances. ('Surgical Contributions,' p. 332.) Some accurate observers have even met with cases of recovery where there was every reason to believe that the peritoneum was involved in the rupture. A case of this description was reported by Mr. Arnott to the Medico-Chirurgical Society in 1843 ('Lancet,' Nov. 1843); and another occurred to the late Mr. Chaldecott, of Dorking. The patient, while his bladder was full, struck the lower part of his abdomen against a post. He fell, but was afterwards able to reach his home with some difficulty, at a distance of one hundred yards. He suffered under all the usual symptoms, and in eighteen hours peritonitis appeared. This was subdued, but again supervened, apparently from rupture of the adhesions. In two months, however, the patient had wholly recovered. ('Lancet,' July 25, 1846, 112.)

The usual period at which death occurs from this accident is in from three to seven days; but Mr. Ellis met with a case in which the person did not die until the fifteenth day. The cause of death is obviously peritoneal inflammation; but a person may die suddenly from this injury as a result of shock. Dr. Paterson has communicated a case of this kind to the 'Association Journal.' (Jan. 28th, 1853, p. 88.) A man, while struggling with another, received a severe kick on the lower part of the abdomen. He fell backwards, and died immediately. On inspection, the brain was congested, but otherwise healthy; the heart was free from disease, but much distended with black coagulated blood. The bladder presented, on the left side of the body, a rent of about two inches; but this organ was in other respects healthy, as well as the urethra. There was some bloody effusion in the cellular tissue. The peritoneum and viscera of the abdomen were uninjured. There were no marks of violence on the body.

When these ruptures are produced by blows they are rarely accompanied by the slightest mark of ecchymosis, or of injury to the skin. Thus, then, there may be no means of distinguishing, by external examination, whether a rupture was really due to violence or to spontaneous causes. They who are unacquainted with this fact, might be disposed to refer the rupture to disease, on the supposition that violence should be indicated by the usual characters externally; but there are numerous cases on record which show that this view is erroneous. During a quarrel one man struck another a severe blow on the lower part of the abdomen. The latter was carried home, confined to his bed, and died in seven days. On inspection, there were only a few superficial excoriations on the skin of the abdomen. The bladder was found ruptured to the extent of two inches in its upper and back part; it was highly inflamed. Throughout the abdomen there were the marks of general peritoneal inflammation, of which the man had died. There was a sanguineous fluid effused, exhaling a strong ammoniacal odour. The person who inflicted the blow was convicted of culpable homicide. ('Ann. d'Hyg.' 1836, 207.) Some doubt seems to have been thrown on the correctness of the medical opinion, that the rupture had been caused by a blow, because there was no ecchymosis or other mark indicative of a severe blow over the region of the bladder. The witnesses properly answered, that ruptures of the viscera of the abdomen from violence were not necessarily attended with the marks of violence found in injuries to other parts, owing to the yielding and elastic nature of the parietes. One mentioned a case that had recently occurred to him, where a soldier had received in the abdomen a kick from a horse, which had ruptured the small intestines, and caused death; but there was not the slightest trace of violence externally.

In another case (*Reg* v. *Eccles*, Lancaster Lent Assizes, 1836), the prisoner, who was half intoxicated, met the deceased in the high-road, and without receiving any provocation, gave him a violent kick on the lower part of his abdomen. The deceased turned sick; he attempted to pass his urine but could not; he was conveyed home, and died from peritonitis in five days. On inspection, there was no ecchymosis, or other injury to the skin indicative of external violence, but the bladder was found ruptured, and the contents extravasated. The rupture was attributed to the blow inflicted by the prisoner. In the defence, it was urged with great plausibility, that as there was no mark of a blow, the rupture might have occurred spontaneously from simple over-distension. The judge in summing up, observed that if the rupture was thus occasioned, it was extraordinary that it should have happened immediately after a violent blow had been struck on the part. The distension of the organ might, however, have rendered the blow *more dangerous* than it otherwise would have been. The prisoner was convicted.

As an attempt may be made, in cases in which death has resulted from this injury, to refer rupture of this organ to natural causes, it may be observed that this is an unusual occurrence; a rupture is almost always the result of violence directly applied to the part, while the organ is in a *distended* state. A *spontaneous rupture* may, however, occur: 1. When there is paralysis, with a want of power to expel the urine. 2. When the bladder is ulcerated or otherwise diseased. 3. When there is an obstruction in the urethra from stricture or other causes. A fatal case of rupture of the bladder arising from obstruction as a result of disease, occurred to Mr. Field ('Med. Times and Gazette,' Dec. 13, 1856, p. 590). The causes of spontaneous rupture are easily recognizable by ascertaining the previous condition of the deceased, or examining the bladder and urethra after death. If a man were in good health prior to being struck; if he suddenly felt intense pain, could not pass his urine afterwards, and died from an attack of peritonitis in five or six days; if, after death, the bladder was found lacerated, but this organ and the urethra were otherwise in a healthy condition, there can be no doubt that the blow must have been the sole cause of rupture and death. In such a case, to attribute the rupture to spontaneous or natural causes would be equal to denying all kind of causation. As to the absence of marks of violence externally, this would be a difficulty only to those who had not previously made themselves acquainted with the facts attending this and other accidents affecting the viscera of the abdomen (p. 393). Nevertheless, a medical witness must be prepared to hear the same line of defence continually urged; it is, of course, the object of a counsel to make the best of a case for the prisoner, and his duty consists in seeing him judged according to law, and not condemned contrary to law. With medical facts, opinions, and doctrines he does not concern himself, so long as they do not serve his purpose. A diseased state of the bladder might probably diminish the responsibilty of an accused person for the consequences; therefore the state of this organ should be closely looked to on these occasions. From the summing up of the judge in the last case, it might be inferred, that the fact of the bladder being *distended* at the time of the blow, would be held a mitigatory circumstance; but we can hardly suppose that such would be the deliberate opinion of our judges. The fact is, this most serious injury is never liable to occur from violence, except when the bladder is actually distended, which is occasionally its natural condition! If there were anything unnatural or abnormal in the bladder containing urine, such a rule might, perhaps, apply; but as it is not so, the rule would hold out to persons a ready means of certainly destroying life without subjecting them to the same degree of responsibility as if they had caused death in any other way. If a pregnant woman be killed by a blow on the abdomen, which causes rupture of the uterus, the act cannot be regarded as admitting of mitigation because the uterus is only occasionally in this distended state. Undoubtedly a blow on the distended bladder or uterus, is more dangerous than when these organs are undistended; but this ought not to diminish the responsibility of an aggressor.

Can the bladder be ruptured by an accidental fall, and if so by what kind of fall?—The following case, reported by Mr. Syme, shows that this accident may readily occur. A woman, aged twenty-six, fell forwards over the edge of a tub, and fainted immediately. On recovering herself, she complained of intense pain in the abdomen, with inability to pass the urine. Peritonitis came on, and she died in a week. On inspection, a small aperture was found in the upper part of the bladder; the peritoneum was extensively inflamed, from the urine which had become effused. The ruptured surfaces had become partly glued together. ('Ed. Med. and Surg. Jour.,' Oct. 1836.) Rupture of the bladder may take place from an accidental fall, and cause death without necessarily laying open the peritoneal cavity. Two cases of this kind have been reported by Mr. Spencer Wells. ('Med. Gaz.' vol. 36, p. 621.) The patients were sailors who fell from their hammocks while in a state of intoxication. The usual symptoms followed; one died in five, and the other in eight days, from peritonitis; and after death it was clearly found, in one instance at least, that the bladder had been ruptured in the usual situation, but the peritoneum was entire, although in a state of intense inflammation. Another case of this kind, which was the subject of a trial (*Reg.* v. *Dixon*, Durham Lent Assizes, 1846), was communicated to me by M. Steavenson. The prisoner kicked the deceased in the pubic region from behind. The man died from peritonitis in thirty-five hours. On inspection, the bladder was found ruptured near its neck for about half an inch, immediately above and to the left of the prostate gland. The urine was extravasated in the cellular tissue of the scrotum: but although there was extensive inflammation, the peritoneum was not lacerated. On the other hand, a remarkable case is reported by Mr. Bower, in which a man died on the sixth day from rupture of the bladder; and after death, although the peritoneum was lacerated, and the cavity of the abdomen was filled with dark-coloured urine, there was no sign of peritoneal inflammation. ('Lancet,' Dec. 19, 1846, p. 660.) This accident is liable to occur in females during parturition, owing to the pressure on the child's head; an occurrence which may throw a charge of malapraxis on the medical attendant. He is expected to know the probability of such an accident occurring, and to guard against it, if necessary, by the frequent use of the catheter. In *Reg.* v. *Balsoner* (Liverpool Lent Assizes, 1838), a surgeon was tried on a charge of this kind. It is important to remember, that although rupture of the bladder is commonly attended, at the time of the occurrence, with intense pain, sickness, and prostration of strength, yet persons may occasionally retain the power of exerting and moving themselves after the accident. (See page 515.)

In punctured and incised wounds of the bladder, the urine is immediately extravasated, but in gun-shot wounds, the extravasation does not commonly take place until the sloughs have separated. Thus, life may be protracted longer in cases of gun-shot than under other wounds of the bladder. Barzellotti relates the case of a medical student, shot through the bladder in a duel, who did not die until the *twentieth day* from the peritonitis which supervened on the extravasation. ('Questioni di Med. Leg.,' t. 3, p. 174.) One instance of a person recovering from a gunshot wound perforating the bladder, is reported by Mr. Douglas in the 'Ed. Med. and Surg. Jour.,' vol. 13. For the discovery of extravasated liquids or blood, in wounds and other injuries to the abdominal viscera, we must look to the cavity of the pelvis, as it is here that, for obvious reasons, such liquids have a tendency to collect.

Wounds of the genital organs.—Wounds of these organs do not often require the attention of a medical jurist: such wounds, whether in the male or female, may, however, prove fatal to life by excessive hæmorrhage. Self-castration or mutilation is not unfrequent among male lunatics and idiots. An inquest was held some time since in London, upon an idiot, who had bled to death from a wound of this description. When timely assistance is rendered a fatal result may be averted. Incised, lacerated, or even contused wounds of the female genitals, may prove fatal by loss of blood, not from the wound involving any large vessel, but from the numerous small vessels which are divided. Two females were in this way murdered in Edinburgh some years since. The wounds were inflicted by razors, and the women bled to death. (See cases by Watson, p. 104.) This crime appears to have been at one time frequent in Scotland. When deeply *incised* wounds are inflicted upon the genital organs of either sex, the fact of their existence in such a situation at once proves wilful and deliberate malice on the part of the assailant. Accident is wholly out of the question, and suicide is improbable, except in cases of confirmed idiocy and lunacy. Such wounds require to be carefully examined; for the proof of the kind of wound, when fatal, may be tantamount to a proof of murder.

A practitioner may be sometimes required to determine whether wounds affecting the female organs have resulted from accident, have been self-inflicted, or inflicted by others with homicidal intention. In June 1842, a woman received a wound in the genitals by a cutting instrument, on the left side, to the extent of one inch and a half in a longitudinal direction, There was a smaller wound on the right side. The accused alleged that the woman had inflicted the injury on herself; and Dr. Easton of Glasgow, on being required to state his opinion on the question at issue, came to the conclusion: 1. From the regular edges of the wounds, that they had been produced by a clean cutting instrument, and therefore could not have been caused by a fall, excepting the person had fallen upon some sharply cutting projection. 2. If the woman had injured herself by thrusting a knife into the private parts, the situation and direction of the wounds would have been different. There was a want of proof to connect the prisoner with the act, and he was discharged. This is an improbable situation for the self-infliction of wounds with a view to suicide. Some rules which have been elsewhere given (p. 396) may enable a witness to form an opinion when a question of this kind is involved in doubt. (For cases in which such wounds were homicidally inflicted upon males—see 'Ann. d'Hyg.' 1848, t. 1, p. 443; also 1865, t. 1, p. 156, and for another which led to a trial for the murder of a female, see 'Med. Gaz.' vol. 14, p. 813.)

Contused wounds on the female genitals prove sometimes fatal, by the laceration of parts leading to great loss of blood. Several trials for manslaughter have taken place in which this was proved to have been the cause of death. (See the case of *Reg.* v. *Cawley*, Liverpool Winter Assizes, 1847, also a paper by Mr. Barrett, 'Assoc. Med. Journal,' June 28, 1856, p. 538.) There may be such a loss of blood in these cases as to destroy life, although no large blood-vessel is implicated in the injury. A contused wound on the vulva may occasionally present an ambiguous appearance and be mistaken for an incised wound. When the soft parts of the body are struck by a blow or kick, if there is a bony surface beneath, a longitudinal rent may appear as a result of the force being received by the bone. A blow on the cranium with the fist produced in one instance a rent which was at first mistaken for a cut. A kick on the vulva, or a fall on this part, may produce a similar injury, and unless carefully examined, may lead to the inference that a weapon has been used for its production. Mr. Barrett, in the paper above referred to, has properly directed attention to this subject. A case in which a contused wound of the clitoris proved fatal has been communicated to the 'Lancet' by Mr. Gutteridge. (Oct. 31, 1846, p. 478.) A woman, æt. 36, received a kick from her husband in the lower part of the abdomen while she was in a stooping posture. She was seen by Mr. Gutteridge in about three-quarters of an hour, and she had then lost from three to four pounds of blood. She was sinking, and expired in a few minutes after his arrival. On inspection there was no injury to the uterus or vagina ; the wound was situated at the edge of the vulva, extending from the pubes along the ramus of that bone. It was about an inch long and three-quarters of an inch deep. The left crus clitoridis was crushed throughout its length, so as to exhibit its cavernous structure. From this the fatal bleeding had proceeded. The heart and great vessels contained no blood. The bleeding from such injuries is always likely to be more profuse when the female is pregnant. A case of recovery from a contused wound to the genitals in a pregnant woman, æt. 40, is reported by Dr. M'Clintock. It is stated that there was profuse bleeding from a laceration involving the urinary passage, but under early treatment the woman did well. ('Medical Times,' May 15, 1847, p. 233.) It is well known that some females are subject to frequent discharges of blood from the genital organs from natural causes. When the bleeding immediately follows a blow, and the woman has not been subject to such a discharge, the fair presumption is that violence was the cause : but when the flow of blood appears only a long time after the alleged violence, of which no traces can be seen, it is most probably due to natural causes. A case of this kind has been communicated to me by Mr. Procter of York. There was no difficulty in giving an opinion that the flow of blood was *not* due to violence.

It may be alleged in defence that the injuries found on the body were inflicted *after death*, and not while the deceased was living. Kicks or blows on the vulva, if they destroy life at all, cause death by copious effusion of blood. Violence to this part after death would not produce such an effusion as would account for death. There are also other distinguishing characters which have been elsewhere pointed out (see p. 385). A case was tried in Edinburgh, in which this defence was set up; but Dr. Simpson was enabled to say, from his observation of the effects of such violence to a dead body, that the injuries in question could not have been produced after death.

CHAPTER 46.

FRACTURES—PRODUCED BY A BLOW WITH A WEAPON OR BY A FALL—OCCUR IN THE AGED—BRITTLENESS OF THE BONES—FRACTURES CAUSED BY SLIGHT MUSCULAR EXERTION—IN THE LIVING AND DEAD BODY—HAS A BONE EVER BEEN FRACTURED? —LOCOMOTION—DISLOCATIONS FROM VIOLENCE OR NATURAL CAUSES —MEDICAL OPINIONS—ACTIONS FOR MALAPRAXIS.

FRACTURES.

FRACTURES of the bones have some important bearings in relation to medical jurisprudence. They may result from falls, blows, or the spontaneous action of muscles.

Causes.—Questions are sometimes put as to whether a particular fracture was caused by an accidental fall or a blow; and if by a blow, whether by the use of a weapon or not. It is obvious that the answers must be regulated by the circumstances of each case. In examining a fracture, it is important to determine, if possible, whether a *weapon* has or has not been used, and this may be sometimes ascertained by the state of the parts. It is a common defence, on these occasions, to attribute the fracture to an accidental fall. Fractures more readily occur from equal degrees of force in the old, than in the young, and in the young rather than in the adult; because it is at the adult period of life that the bones possess their maximum degree of firmness and solidity. The bones of aged persons are sometimes very *brittle*, and slight violence will then produce fracture. This has been regarded as an extenuating circumstance, when the fracture produced by a slight blow was followed by death. Certain diseases, such as syphilis, arthritis, cancer, scurvy, and rachitis, render bones more fragile; but they are sometimes preternaturally brittle in apparently healthy persons, and this brittleness appears to be hereditary. ('Dub. Hosp. Gaz.' Feb. 1846, 189.) In such cases, a defence might fairly rest upon an abnormal condition of the bones, providing the violence producing the fracture was slight. Several trials have taken place in which this brittleness of the bones became a subject of enquiry. In a case of fractured skull leading to death from inflammation of the brain, it was proved that the bones of the skull were occasionally thin and brittle, and this led to a mitigation of punishment. (*Reg.* v. *Kennedy*, Gloucester Winter Assizes, 1855.) The orbitar plate of the frontal bone is very thin, and it may be fractured by a blow on the eye. (*Reg.* v. *Wilson*, Oxford Lent Assizes, 1859.) Death was here caused by inflammation of the brain as the result of such a fracture.

Spontaneous Fractures.—In a case in which there is no appearance of disease, a fracture may be ascribed to spontaneous causes. Thus bones have been fractured by moderate muscular exertion. The elbow (olecranon), heel-bone (os calcis), and knee-pan (patella) are particularly exposed to this accident. The long bones are seldom the subject of an accident of this kind; but the arm (os humeri) in a healthy man has been broken by the simple muscular exertion of throwing a cricket-ball. ('Medical Gazette,' vol. 16, 659.) Mr. May reports the case of a young lady, who fractured the neck of the scapula by suddenly throwing a necklace round her neck. ('Med. Gaz.' Oct. 1842.) In July 1858, a gentleman, æt. 40, was in the act of bowling at cricket, when on delivering the ball, he and some bystanders heard distinctly a sharp crack like the breaking of a dry piece of wood. He fell to the ground as if he had been shot. The thigh-bone was found to be fractured, and evidently from muscular exertion only. No person can meet with an accident of this kind without being instantly conscious of it. It is probable that in these instances, if there were an opportunity of examining the bone, it would be found to have undergone some chemical change in its composition, which had rendered it brittle. A case of spontaneous fracture of the femur was brought into Guy's Hospital, in December 1846. A healthy man, æt. 33, of temperate habits, was in the act of placing one leg over the other to look at the sole of his foot, when he heard something give way, and the right leg immediately hung down. On examination, it was found that the right thigh-bone had been transversely fractured at the junction of its middle with the lower third. This case is remarkable inasmuch as spontaneous fractures of the thigh-bones are very rare,—as the man had not suffered from any of those diseases which cause preternatural fragility, and the fracture was not caused by violent muscular exertion. The actual condition of the bone was of course unknown; but it healed readily, and the man left the hospital at the usual period. In fractures arising from this cause there will be no abrasion of the skin, nor any appearance to indicate that a blow has been struck; while the marks of a blow would, of course, remove all idea of the fracture having had a spontaneous origin. It is most unusual that the ribs should be fractured from muscular exertion; but a case occurred to Dr. Groninger, which shows that this accident may really occur. It is only of medico-legal importance, inasmuch as the injury might be ascribed to violence; but the absence of any external appearances indicative of a blow would show that this was not the cause. Dr. Groninger's patient was a strong healthy labourer, aged 45, who, slipping while walking, only saved his footing by the exertion of considerable strength. While recovering his balance he felt a sharp pain on his right side, which was aggravated by inspiration and by exertion, so that he reached home with difficulty. On examination a tender spot of about half a hand's breadth was found in the axillary region over the seventh and eighth ribs. Crepitation was not distinct, and emphysema was not present. As the pain occurred so suddenly and was limited to so small a space, it was contended that a rupture of the muscular fibres had taken place, although the absence of all swelling and effusion, as well as of any depression amidst the fibres, rendered this not very probable. Pleurisy was set up, and the patient was confined to bed for a fortnight; when all traces of pain had left the part, the deposition of callus (new bone) plainly showed that there had been fractures of the seventh and eighth ribs. ('Archiv. der Heilkunde,' vol. 1, p. 473; also 'Med. Times and Gaz.,' April 1861, p. 450.)

Fractures are not *dangerous to life*, unless, when of a compound nature, they occur in old persons, or in those who are debilitated by disease or dissipated habits. They may then cause death by inducing irritative fever, erysipelas, gangrene, tetanus, pyæmia, or delirium tremens.

Fractures in the living and dead body.—It is not always easy to say whether a fracture has been produced *before or after death.* A fracture produced shortly after death, while the body is warm, and another produced shortly before death, will present similar characters, except that in the former case there might be less blood effused. A fracture caused ten or twelve hours before death would be indicated by a copious effusion of blood into the surrounding parts and between the fractured edges of the bones, as well as by laceration of the muscles; or if for a longer period before death, there may be the marks of inflammation. Fractures caused several hours after death are not accompanied by an effusion of blood. A medical witness may be asked, How long did the deceased survive after receiving the fracture? This is a question which can be decided only by an examination of the fractured part. Unless the person has survived eighteen or twenty-four hours, there are commonly no appreciable changes. After this time, lymph is poured out from the surrounding structures. This slowly becomes hard from the deposition of phosphate of lime, and forms what is called a 'callus.' In the process of time, the callus acquires all the hardness of the original bone. The death of a person may take place during these changes, and a medical man may then have to state the period at which the fracture probably happened, in order to connect the violence with the act of a particular person. Unfortunately, we have no satisfactory data, if we except the extreme stages of this process of repair, upon which to ground an opinion. We can say whether a person lived for a long or a short time after receiving a fracture, but to specify the exact time is clearly impossible; since this process of restoration in bone varies according to age, constitution, and many other circumstances. In young persons, bones unite rapidly, in the old slowly; in the diseased and unhealthy, the process of union is slow, and sometimes does not take place at all. In those who are at the time affected with a mortal disease there is no attempt at reparation. According to Villermé, the callus assumes a cartilaginous structure in from sixteen to twenty-five days; and it becomes ossified in a period varying from three weeks to three months. It requires, however, a period of from six to eight months for the callus to acquire all the hardness, firmness, and power of resisting shocks possessed by the original bone. A force applied to a recently united bone will break it through the callus or bond of union, while after the period stated, the bone will break as readily through any other part. It is generally assumed, that the period required for the union of a simple fracture, is, for the thigh-bone, six weeks; for the tibia (leg), five weeks; for the os humeri (arm), four weeks; and for the ulna and radius (forearm), three weeks; for the ribs, about the same period: but cases have been known in which the ribs had not perfectly united in two months, and in some fractures of the other bones, it was found that union had not taken place in four months. In a case which occurred to Dr. Reid (*ante* p. 529), a fracture of the tibia, the principal bone of the leg, had healed in three weeks.

Has a bone ever been fractured?—This question is sometimes put in reference to the *living* subject. It is well known that a bone seldom unites so evenly that the point of ossific union is not indicated by a node or projection. Some bones are so exposed as to be well placed for this examination, as the radius, the clavicle, and tibia,—these being but little covered by skin; in others the detection is difficult. It is impossible for us to say when the fracture took place; it may have been for six months or six years,—as, after the former period, the bone undergoes no perceptible change. These facts are of importance in relation to the *dead* as well as to the living; since they will enable us to answer questions respecting the identity of skeletons found under suspicious circumstances: and here medical evidence may take a wider range, for a fracture in any bone may be discovered, if not by external examination, at least by sawing the bone longitudinally through the suspected broken part, when, should the suspicion be correct, the bony shell will be found thicker and less regular in the situation of the united fracture than in the other parts. So, in such cases, it will be easy to say whether a fracture is recent or of old standing. (See pages 92 and 111.)

Locomotion.—With respect to the power of *locomotion* after a fracture, it may be observed, that when the injury is in the arm or in the ribs—unless many of them are broken or the fractures are on both sides—a person may be able to move about, although unfitted for struggling or making great exertion. Fractures of the leg generally incapacitate persons from moving except to short distances. See case by Syme, 'Ed. Med. and Surg. Journal,' Oct. 1836; also another in which one bone of the leg was fractured and a power of walking some miles was retained. ('Amer. J. Med. Sci.,' Oct. 1845, p. 484.) The reader will find additional information on this subject in the 'Ann. d'Hygiène,' 1839, t. 2, p. 241; 1844, t. 2, p. 146, and in Friedreich's 'Ueber der Knochen in forensischer Beziehung, Ansbach,' 1853.

DISLOCATIONS.

Dislocations are not frequent in the old or in those persons whose bones are brittle. They rarely form a subject for medico-legal investigation. A witness is liable to be asked, what degree of force, and acting in which direction, would produce a dislocation,—questions not difficult to answer. They are not dangerous to life, unless of a compound nature, when death may take place from secondary causes. A dislocation which has occurred in the *living body* may be known after death by a laceration of the soft parts in the neighbourhood of the joint, and by the copious effusion and coagulation of blood. [For an account of the appearances presented by a dislocation of the shoulder four days after death, see 'Med. Gaz.' vol. 31, p. 266.] If of old standing, a dislocation would be identified by the cicatrices in surrounding structures. Dislocations may occur from *natural causes*, as from disease and destruction of the ligaments in a joint; also from violent muscular spasm during an epileptic convulsion. Dr. Dymock met with an instance of dislocation of the shoulder forwards during puerperal convulsions. ('Ed. Med. and Surg. Journal,' April 1843; see also 'Lancet,' April 1845, p. 440.) A power of *locomotion* may exist, except when the injury is in the lower limbs: but it has been observed, that for some time after a dislocation of the hip-joint, considerable power over the limb remains; it is only after a few hours that the limb becomes fixed in one position. Exertion with the dislocated member is in all cases out of the question.

Detection of fractures. (*Malapraxis.*)—There are certain fractures of an obscure kind which closely resemble dislocations. This has been pointed out by Sir A. Cooper, in relation to fractures of the anatomical neck of the os humeri (arm-bone). ('Guy's Hosp. Rep.' No. 9, p. 272.) This accident might easily be mistaken for a dislocation of the shoulder. ('Med. Gaz.' vol. 36, p. 38.) In attempting to reduce the bone, the head continually falls back into the axilla. In such a case an action for malapraxis might be brought against a surgeon, and heavy damages recovered. It could only be by a dissection of the part after death that the real nature of the case would be ascertained. It is requisite, therefore, that great caution should be used in giving an opinion. The same observations apply to fractures of the neck of the thigh-bone, although with less force, because this is a more common accident. It is well-known that fractures and dislocations, when cured, are often attended with some slight *deformity* of the limb, or with some impairment of its functions. This result is occasionally inevitable under the best treatment; but it is commonly set down as a sign of unskilfulness in the medical attendant. An action for malapraxis is instituted, and, in spite of good evidence in his favour, the surgeon is sometimes heavily fined for a result which could not be avoided. There is often great injustice in these proceedings, and the mischief can only be remedied by referring the facts to a competent medical tribunal, which alone should be empowered to decide whether or not unskilfulness had really been shown in the management of a case. The system of allowing each party to select his own medical witnesses invariably leads to a conflict of opinion and evidence.

CHAPTER 47.

GUNSHOT WOUNDS—THEIR DANGER—IN THE LIVING AND DEAD BODY—WAS THE PIECE FIRED NEAR OR FROM A DISTANCE?—EVIDENCE FROM SEVERAL WOUNDS—THE PROJECTILE NOT DISCOVERED—DEFLECTION OF BALLS—ACCIDENTAL, SUICIDAL, OR HOMICIDAL WOUNDS—POSITION OF THE WOUNDED PERSON WHEN SHOT—WOUNDS FROM SMALL-SHOT—WOUNDS FROM WADDING AND GUNPOWDER—IDENTITY FROM THE FLASH OF POWDER—EXAMINATION OF THE WEAPON.

GUNSHOT wounds are of the contused kind, but they differ from other wounds in the fact that the vitality of the parts struck by the projectile is destroyed, and this leads ultimately to a process of sloughing. The legal definition of a wound applies here as in other cases, so that, in order to constitute a gunshot wound in a legal sense, the cutis or true skin, must be injured. In *The Queen* against *Mortlock* (Cambridge Lent Assizes, 1843), the surgeon deposed that there was a circular wound on the skin, by which it had been deprived of its cuticle, but the true skin was not penetrated. The bullet had struck obliquely at a considerable angle; had it been otherwise, it must have entered the abdomen. The judge said that, as the true skin was not penetrated, there was no wounding within the meaning of the statute.

Their danger.—The medico-legal questions which arise out of gunshot wounds, are similar to those which have been examined in relation to other wounds. They are *dangerous to life*, especially when they penetrate or traverse any of the great cavities of the body. Death may take place directly, either from loss of blood or from shock; although immediate or copious bleeding is not a common character of these injuries. Death from shock is occasionally witnessed. In the case of *Daly*, who was killed by a pistol-bullet in Hornsey Wood, May 1842, it was found, on inspection, that the bullet had traversed the distended stomach at the greater end from behind forwards. The two apertures were about the size of a shilling, and the edges black. There was but little blood effused, and the other viscera were uninjured. The deceased died in a few seconds after receiving the wound, obviously from a shock to the nervous system. ('Lancet,' May 1842.) Indirectly, these wounds are attended with much danger; sloughing generally takes place uniformly throughout the whole of the parts perforated, and inflammation or fatal bleeding may cut short life. If the person survives the first effects, he may die at almost any period from suppurative fever, erysipelas, gangrene, or from the results of operations absolutely required for his treatment. Gunshot wounds may thus destroy life after long periods of time. Mr. Longmore records a case in which a man was shot in the right loin at the siege of Sebastopol, on the 16th April 1855. He died from the effects of the wound on the 13th February 1859, three years and ten months after the injury. ('Guy's Hospital Reports,' 1859, vol. 5, p. 173.) Marshal Maison, one of the generals of Napoleon I., died in Paris in 1840, as it is reported, from the effects of a gunshot wound received forty years before. Without resting upon the last-mentioned case, instances of gunshot wounds proving fatal after a year and a day are not unfrequent, and they strongly show the inconsistency of limiting the legal responsibility of an assailant by the period at which death takes place. (See pp. 479 and 544.) In gunshot wounds of a severe kind, the first symptoms by no means indicate the degree of mischief. Thus in the case of Mr. Drummond, who was shot by *M'Naughten*, in January 1843, the symptoms were in the first instance so slight, that the bullet was supposed not to have penetrated the cavity of the abdomen, but to have coursed round the skin. Death took place in a few days, and it was then found that the bullet had completely traversed the abdomen, perforating the diaphragm. Army-surgeons have also remarked that slight wounds of the coverings of the abdomen are often insidiously attended with deep-seated injury. Death might in such a case be improperly ascribed to mismanagement, when it may have been really caused by the wound. (See cases by Sir Rutherford Alcock, 'Med. Gaz.' vol. 24, p. 850.) It is not easy to mistake a gunshot wound for any other injury. If the circumstances under which it is produced do not satisfactorily account for its origin, a simple examination will generally suffice to show its true nature. Sometimes the projectile, or a part of the dress, is found lodged in the wound. Mr. Ward has reported a singular case in which a perforating wound of the skull, inflicted with a red-hot poker, produced in the bones a small sharply-defined circular opening nearly half an inch in diameter. It bore a close resemblance to a bullet wound. The absence of a bullet showed that it had not been produced by any projectile. ('Med. Gaz.' vol. 44, p. 767.)

In the living and dead body.—A medical witness may be asked whether the wound was inflicted *before or after death.* It is by no means easy to answer this question, unless the bullet has injured some vessel, when the effusion of blood and the formation of coagula will indicate that the person was living when it was received. If a gunshot wound has been produced in a dead body, no blood will be effused unless the bullet strikes a large vein.

Was the piece fired near or from a distance?—A gunshot wound produced by the muzzle of a piece being placed near to the surface of the body, has the following characters:—There may be two apertures, the one of *entrance* and the other of *exit*; but it sometimes happens that the bullet lodges and does not pass out. The edges of the aperture of entrance are generally torn and lacerated, and appear blackened, as if they had been burnt: this arises from the heat and flame of the gunpowder at the moment of explosion. The skin is often ecchymosed, and is much discoloured by the powder:—the clothes covering the body are blackened by the discharge, and sometimes ignited by the flame. If the muzzle of the piece was not in immediate contact with the part struck, the wound is rounded; but if there has been direct contact, the skin, besides being burnt, is torn and much lacerated. The bleeding is usually slight, and when it occurs it is more commonly observed from the orifice of exit than from that of entrance. It should be remarked that the aperture of entrance is round only when the bullet strikes point-blank or nearly so. If it should strike obliquely, the orifice will have more or less of an oval or valvular form; and by an observation of this kind we may sometimes determine the relative position of the assailant with respect to a wounded person. Supposing the bullet to have been fired from a moderate distance, but so near as to have had sufficient momentum to traverse the body, then the appearance of the wound will be different. The *orifice of entrance* will be well defined, round or oval, according to the circumstances,—the skin slightly depressed,—the edges presenting a faintly bruised appearance; but the surrounding parts are neither blackened nor burnt, and they do not present any marks of bleeding. In these cases the *orifice of exit* is large, irregular, the edges somewhat everted, and the skin lacerated, but free from any appearances of blackness or burning: it is generally three or four times as large as the entrance-aperture. This is denied by Dr. Malle ('Ann. d'Hyg.' 1840, t. 1, p. 458), but it appears to me upon insufficient grounds. The orifice of entrance is generally large and irregular when the bullet strikes near the extremity of its range. Under common circumstances, the entrance-aperture may have the appearance of being smaller than the projectile, owing to the elasticity of the living skin. ('Ann. d'Hyg.' 1839, t. 2, p. 319.) It is the same with the aperture in the dress, when this is formed of an elastic material. According to Dupuytren, the hole in the dress is always smaller than that made by a bullet in the skin. These points should be remembered in fitting projectiles to wounds which they are supposed to have produced.

Useful evidence may be sometimes obtained by a careful examination of the projectile, which, if found, should be preserved by the medical witness for the purpose of identity. When the projectile cannot be found, and there are no marks of burning, or other signs of a near wound on the skin, we must be cautious in expressing an opinion. In the case of *The King* against *Howe and Wood* (Stafford Lent Assizes, 1813), it was proved that the deceased had died from a gunshot wound in the back. The bullet extracted from the wound was found to have been discharged from a pistol with a screw-barrel. A weapon of this kind was found on the prisoner, as well as a bullet which had evidently been cast in the same mould as that taken from the body of the deceased. (Wills's 'Circ. Evidence,' 264.) On these occasions, the medical attendant should either keep possession of any of the projectiles, which he may remove from a wound, or deliver them only into the hands of responsible persons. An examination of the *dress* alone will sometimes enable us to give an opinion as to where the bullet had passed in, and thus to form a judgment of the direction in which the shot was fired. If a ball strikes at a moderate distance, the aperture in the dress where it enters is round, and the margin is regularly defined; but the aperture by which it passes out is irregular and torn. In the case of a friend who was wounded in Paris during the revolution of 1830, the ball traversed the left arm:—it had taken out a circular piece of the coat, shirt, and undershirt, where it had entered; but it produced a large irregular opening where it had passed out. Sometimes portions of the dress are carried into the wound,—or, if the ball be nearly spent, the dress is elongated like a pouch into the wound. By putting the edges of the cloth together where the bullet has passed in, it may be seen whether any of the cloth has been carried before it. The holes are generally ragged, but the nearer the wounded person is to the assailant, the more perfect is the hole in the dress,—provided the piece be not discharged in immediate contact. The bruised and dark appearance which a gunshot wound sometimes presents, even when the piece is discharged at a distance from the body, led to the supposition that this effect was due to a burn, and that the bullet burnt the parts which it touched; but this idea has been long exploded. The projectile never becomes sufficiently heated to acquire the least power of burning.

The question whether a piece was fired *near to, or at a distance from*, the wounded person, may be of some importance either on a charge of homicide, or of alleged suicide. Two persons may quarrel, one having a loaded weapon in his hand, which he may allege to have been accidentally discharged, and to have killed the deceased. If the allegation is true, we ought to find on the body the marks of a near wound: if, however, its characters were such that it had obviously been produced from a distance, and therefore after the quarrel, medical proof of the fact might imply malice and involve the accused in a charge of murder. The following case occurred in Ireland in 1834:—A tithe-collector was tried for the murder of a man by shooting him. It appeared in evidence that the prisoner, while on duty, was attacked by the deceased and two of his sons, and he drew a pistol to intimidate them. He was dragged off his horse by these persons, and during the scuffle, it is supposed, the pistol was discharged accidentally and inflicted a wound on the deceased, of which he died shortly afterwards. The sons of the deceased swore that the prisoner took a deliberate aim, and fired the pistol at their father when at some distance; and a priest came forward to depose that such was the dying declaration of the deceased. From some doubt of the truth of this story, the body, which had been carelessly inspected in the first instance, was ordered to be disinterred. It was carefully examined by a surgeon, who was enabled to swear positively, that the pistol must have been fired close to the body of the deceased, and not at a distance, since there were the marks of powder and burning on the wrist. Hence it clearly followed that the pistol had not been discharged at a distance, but during the scuffle, either by accident or in self-defence. The prisoner was acquitted, and the parties who had appeared as witnesses against him were indicted, and convicted of perjury. In the case of Mr. *Pearce*, a surgeon, who was tried at the Central Criminal Court, in 1840, for shooting at his wife, and was found insane, it appeared from the medical evidence that the pistol had been fired so near to the person of the prosecutrix, that her dress was burnt and the skin blistered. Mr. Marshall relates that when stationed at Ceylon with troops, a man, who had but recently joined the regiment, was placed as sentry in a position where he was occasionally fired at by the enemy from the surrounding jungle. The man was one day found severely wounded; the calf of his leg was greatly torn, the whole charge of a musket having passed through it. He attributed the wound to a shot from the enemy: but from the skin of the leg having been completely blackened by charcoal, it was clear that it must have arisen from the discharge of his own musket. He had inflicted this wound upon himself in order to obtain a discharge from the regiment. These examples, then, show that both the dress and skin of a person who has received a gun or pistol-shot wound should be closely examined. The result may be, that the statement given of the mode in which a wound was received, will be entirely disproved. The case of M. *Peytel*, tried in France, in September 1839, furnishes an additional illustration. This gentleman was travelling in a carriage, in company with his wife, and attended by a man-servant. The wife and the man-servant were found dead on the road, and the account given by M. Peytel was, that the servant had discharged a pistol into the carriage and shot his wife, and he had afterwards pursued and killed him. The facts, however, were so suspicious against M. Peytel that he was charged with the double murder. From an examination of the body of the wife, it appeared that there were two pistol-wounds in the face, which had most probably been produced by two separate pistols. The prisoner alleged that about nine o'clock at night, when it was dark, he desired the servant to get down and walk in order to relieve the horses. Two minutes afterwards some man, whom he found to be the servant, approached the carriage-door, discharged a pistol at him, and wounded his wife; but the evidence showed that two weapons must have been used, or at least two different discharges made by a person sitting very near to the deceased, so that the muzzles must have almost touched her face—the eyelashes and skin having been much burnt by the powder. These facts, together with other strong circumstances against him, led to the prisoner's conviction. The late Dr. Ollivier, who appeared in the prisoner's favour, considered that the deceased might have been shot by the servant, and that the two wounds might have been produced by one pistol loaded with two bullets; also, that the marks of burning about the face of the deceased might be attributed to the wadding, and, therefore, they afforded no proof that the muzzle of the pistol had, at the time of its discharge, been close to her person. He further contended that the deceased had not died from the wounds. Notwithstanding these ingenious suggestions, there can be no doubt that the prisoner was properly convicted. (See 'Ann. d'Hyg.,' 1839, t. 2, p. 339; 1842, t. 1, p. 368.) The amount or degree to which the clothes and body of a person may be burnt by the near discharge of firearms has given rise to medico-legal inquiry. A fact of this kind can only be determined by the circumstances of each case. ('Ann. d'Hyg.,' 1860, t. 1, p. 125.

It has been said that when a bullet is fired near, it commonly traverses the body; and therefore it has been rather hastily assumed, that when there is only one external wound, and the bullet has lodged in the body, this is a proof that the piece has been fired from a distance. This inference is, however, erroneous. A bullet may be fired close to a person and yet not traverse the body, either from its impulsive force not being sufficiently great, or from its meeting a great resistance in its course. Many cases might be cited to show, that in the near wounds produced by suicides and murderers, the bullets have not always traversed the body (p. 512). In suicide, when the piece is discharged into the mouth, the projectile often lodges in some part of the head.

Evidence from several wounds.—When several wounds are found on a body, can we determine whether they were produced by one or several different discharges? This question was raised in *Peytel's* case, as there were two wounds on the deceased, and the prisoner alleged that the servant had fired but one pistol. M. Ollivier thought that this might be explained by supposing that there had been two bullets in the pistol:—it was, however, affirmed by some military officers and other witnesses, that these wounds had been produced by separate pistols—a fact which overthrew the defence of the prisoner. ('Ann. d'Hyg.' 1842, t. 1, p. 368.) It is proper to remark that one ball may sometimes produce several wounds on the body; there will be only one orifice of entrance, but owing to the ball occasionally splitting within the body, and dividing itself into three or four pieces, there may be several orifices of exit. This splitting of a ball has repeatedly occurred when the projectile in its course has encountered an angular surface, or a projecting ridge of bone. Dupuytren met with an instance, in which a ball, after having struck the ridge of the bone of the leg (the tibia), divided itself into two parts, which traversed the calf of that leg, and penetrated into the calf of the opposite leg. Thus no fewer than five wounds were produced in one instance by a single ball—three of entrance and two of exit. Had this man been found dead, and nothing known concerning him, this singular circumstance would probably have given rise to considerable embarrassment. After a careful examination, a surgeon might have been induced to declare, that this person must have received at least three distinct shots. A similar effect was observed in another case, in which the bullet struck the parietal bone of the head and divided itself into two portions:—one passed out superficially through the skin, the other penetrated into the brain, and lodged on the tentorium. This fact shows, that the discovery of an exit-aperture does not always prove that the whole of a projectile has passed out,—a matter which may influence a medical opinion as to the result.

In the case of Mr. *Drummond*, who was shot by *M'Naughten* in 1843, the pistol was discharged close to the back of the deceased. The ball, however, had not traversed the body, but had lodged beneath the skin in the forepart of the abdomen. In the case of *Latham*, shot by *Buranelli* in 1855, although the pistol was discharged close to the deceased, the bullet lodged in the second vertebra of the neck, where it was found after death. It is then, it appears to me, out of the power of a witness to say, from the mere fact of a bullet lodging or traversing, whether the assassin was far off or near at the time the deceased was wounded. The latter point may be sometimes readily determined by the marks of injury and burning about the skin and dress. When a gun or pistol is discharged at the distance of three or four yards from the person, it will not, of course, produce those marks of blackening, burning, and bruising on the skin which are found when the muzzle is within a few inches of the body. Such a wound may remove the suspicion of suicide, and create a strong presumption of homicide. Dr. Lachèse found that in firing a gun at the distance of four feet, the skin was only partially blackened. It would be very important in a case of this kind to notice the direction of the wound as well as the relative position of the assailant and assailed, as stated by witnesses or deduced from circumstances. In this respect the facts connected with the death of *Charles XII. of Sweden* are of some interest. On the night of the 11th of December 1718, the king, who was besieging the fortress of Frederickshall, during an examination of the works, clambered up a mound facing the enemy's batteries and within reach of their fire. There were with him, but at different distances from him, several noblemen. Suddenly the king gave a deep sigh, and fell dead on the parapet, with his face towards the fortress. A ball had struck him on the right temple, traversed the brain from right to left, and forced the left eye from its socket. The direction of the wound tended clearly to prove that the king was not struck by a ball from the battery which he was facing, but that this had been fired from some person on his right hand. Suspicion fell upon a M. Siquier, who was at that time in attendance on the king: whether this was well founded or not, there can be but little doubt that the king was assassinated.

The projectile not discovered.—It is not absolutely necessary for the conviction of a person on a criminal charge of maliciously shooting at another, that the bullets or shot should be produced, or that they should even have been found on a post-mortem examination of the body. In the case of *The Queen* v. *Cottrell*, tried in 1839, the deceased was seen to drop, and his face was covered with blood. On persons going up to him he was found dead. The medical evidence established that there was a gunshot wound in the left eye, leading to the brain, and that this had caused death. The shot could not be found. The prisoner's counsel objected on this ground, that there was no proof of a gunshot wound having been inflicted; but the judge held that the circumstances were sufficient to warrant the jury in inferring that the deceased had been struck by some substance from the gun, which had caused his death; and it was not necessary to prove whether this had been done by leaden shot or pellets. If, however, it should happen that no wound was produced by the discharge, there would be a want of evidence as to whether the piece was loaded or not, and the accused would probably escape on this ground, unless he were very near to the party whom he attacked, or the bullet were discovered. This subject gave rise to much discussion in the case of *The Queen* against *Oxford* in 1840. By this case it seems to have been decided, that the proof of a piece being loaded with ball or shot is not necessary, provided the prisoner were so near to the party when he fired it, that mischief might be done by the wadding or gunpowder only. This, as we shall presently find, becomes occasionally a medical question.

Was the piece loaded with ball?—At one of the trials which took place for an attempt on the life of the Queen, it was asked whether it were possible to determine if a recently discharged gun or pistol had been loaded with ball or not. It is impossible to give an answer to this question, merely by an examination of the weapon. The report, if heard, is said to be louder and sharper in the case of a piece loaded with ball, than when it is charged with gunpowder and wadding only. If a piece were fired in a direction, so that the projectile met with any hard or resisting object,—the fact of a bullet having been used would be proved, if not by the discovery of a flattened projectile, by the trace of a deep leaden mark in the situation of the part struck.

Deflection of balls.—When a ball traverses the body, it sometimes happens that the two apertures are opposite to each other, although the ball may not have taken a rectilinear course between them, but have been variously deflected by the subjacent soft parts. This deflection of a ball from a rectilinear course is met with in those cases in which it happens to strike obliquely a curved surface, and it is found that when the ball enters and does not pass out, its course is often circuitous, so that it is not always easy to say in what part of the body it will be found. In 1830, I saw at the Hôtel-Dieu, in Paris, a boy who had received a gunshot wound in the upper part of the abdomen: the entrance-orifice was plainly situated there, but there was an opening at the back, nearly diametrically opposite, out of which the ball had passed, so that it conveyed the impression that the ball had completely traversed the abdominal cavity. There was, however, no sign of collapse or depression, nor any indication of serious injury; and Dupuytren gave an opinion, which was afterwards verified,—that the ball had not penetrated, but had been deflected beneath the skin, and had taken a circuitous course through the cellular membrane to the back. Many similar facts are recorded. The same deflection may occur even when the piece is discharged close to the body, as in cases of suicide. Mr. Abernethy was once called to examine a man, who had shot himself, as it was supposed, through the head. He found two openings in the scalp, nearly opposite to each other; it was soon perceived, on examination, that the ball had not penetrated the bone, but had followed the curve of the exterior of the skull to its point of exit. The deflection of projectiles may occur not merely when they come in contact with bone, but when they meet skin, muscles, tendons, or membranes,—the ball then takes its course in the spaces between these different structures. A ball which entered at the ankle has been known to make its exit at the knee; and another, which entered at the back of the left shoulder, passed down on the inside of the scapula, and was found below the right ear. This deflection of a ball by slight obstacles has been ascribed partly to the obliquity with which it strikes, and partly to the rotatory motion on its axis which every spherical projectile is considered to have. It does not appear to be much connected with the degree of velocity, for the same deviation has been found to occur when the bullet was fired near or at a distance.

If we can at any time discover two fixed points where a ball has touched a building without being deflected, it will be easy to determine the *situation* from which the piece was discharged. An illustration of this is given by Mr. Watson. The case occurred at Ayr in 1831. Several shots had been maliciously fired into a church. Some of the bullets traversed a window, making holes in the glass, and struck against a wall on the other side of the church,—a fact plainly indicated by the marks which they left. A straight line carried from these two points reached a window on the opposite side of the street, from which it was afterwards ascertained the bullets had been fired. In a case tried at the Kingston Lent Assizes, 1862, a similar piece of evidence clearly showed that a gun loaded with a bullet had been maliciously discharged with a design to kill one of two persons. The prosecutrix and her mother were sitting by candle-light one evening near a window in their house, so that their shadows were projected on a blind: a bullet passed through the window and struck the wall of the house inside. A line drawn between these points was about half an inch over the head of the prosecutrix, and about one inch below the level of her mother's head. Neither was hurt. The prisoner was connected with the act by his having been seen near the spot, and by a variety of circumstances. With that contempt which counsel sometimes show for the common-sense of jurymen whom they have to address on these occasions, it was alleged in defence that the prisoner had gone out with his gun (in the evening) to shoot birds (with bullets) and that the piece had been discharged by some accident! The fact that the prosecutrix had not been hit was, he contended, in favour of the view of an accidental discharge! The learned judge directed the jury to consider with what intent a shot could have been fired so as to come within half an inch of the head of a person. The prisoner was convicted.

Survivorship.—A witness may be asked—When was the gunshot wound inflicted, and how long did the wounded person *survive* after receiving it? Like other wounds, a gunshot wound undergoes no change for eight or ten hours after its infliction. Our judgment in reference to these questions may be assisted by observing the parts which are involved, although we cannot always infer from the quantity of blood found near to a body that the bleeding was an immediate consequence of the wound, or that the whole of the blood was effused at once. We cannot, then, always affirm that the deceased could not have moved or exerted himself in some degree, after receiving it. The exertion thus made subsequently to his being wounded, may have actually caused the fatal bleeding.

Suicidal or Homicidal Gunshot wounds.—When it is doubtful whether the wound was the result of suicide or homicide, the point may be sometimes determined by paying attention to its situation and direction. *Suicidal* gunshot wounds are almost always directed to a vital part—to the heart or to the brain: they possess those characters which belong to wounds inflicted near to the body. The skin is discoloured or burnt, the wound wide and lacerated, the hand which discharged the weapon often blackened, and sometimes still grasping the pistol. The ball may or may not have traversed, as this will depend on the momentum which it derived from the charge, and the resistance that it experienced. (See the case of *The Queen* v. *Thomas*, Brecon Lent Assizes, 1845.) The situation in this instance negatived the supposition of suicide. Suicidal gunshot wounds are seldom situated at the back of the body; therefore the determination of the point of entrance, if the ball has traversed, is of some importance. The direction of these wounds is probably of less moment than their situation, because the projectile is liable to be deflected in the body. In a duel which occurred in Paris, in 1827, one of the parties, a tall man, was killed by a ball which was found to have entered below the right shoulder, and to have taken a direction downwards. In consequence of this, it was thought that he had been shot unfairly by his antagonist, who was short in stature. Breschet and others explained the suspicious course of the wound by assuming that the ball had struck the under part of the clavicle, and had thence probably been deflected downwards. This question excited considerable attention at the trial of a Dr. *Smith* for the murder of a *William Macdonald*, at St. Fergus, in Scotland (High Court of Justiciary, Edinburgh, April 1854). It appeared from the evidence that the deceased was found dead in a field belonging to the prisoner, on the morning of Sunday the 20th November 1853. The body, according to the testimony of eyewitnesses, was lying at full length on its left side in a ditch. The left arm was partly beneath, and the right partly across the body. There was a blackened wound or hole in the cheek, and a little blood on the cheek. A pistol was lying on the ground, according to one witness, about four feet from the head of the deceased. The time at which the deceased died was fixed with tolerable precision at twenty-five minutes before eight o'clock on the evening of the 19th November; and although the prisoner was not seen near the spot, there was evidence that he had made an appointment to meet the deceased that evening, and the testimony of many witnesses showed that he had had an opportunity of being on the spot at the time when the discharge of a pistol had been heard. The defence was, that this was an act of suicide. The pistol could not be identified as belonging to the prisoner; and one witness for the defence positively swore that, six years before, he had sold to the deceased a pistol resembling that found near his body! Upon this statement, and upon the failure of the medical evidence to throw any light upon the important question of homicide or suicide, the prisoner was discharged on a verdict of Not Proven. ('Med. Times and Gazette,' April 22 and May 20, 1854.)

It was proved by the two medical witnesses who gave evidence at the trial, that deceased had died from a pistol-shot, the bullet having penetrated the brain. From the characters of the wound, one thought that the muzzle of the pistol, when discharged, must have been within from three to twelve inches of the face. He admitted that, as an act of suicide, the body might have assumed the position in which it was found, but that the probabilities were against it. The other witness thought that the pistol, when discharged, might have been twelve or thirteen inches from the face; and although a person standing could, in his opinion, have made the wound that appeared on the cheek, yet a suicide would probably have made more sure of his aim, by selecting another position. The only information regarding the wound was, that it was in the right cheek, below the malar prominence; that the opening was blackened, and the nose scorched with gunpowder. It appears that the medical witnesses did not see the body until after the lapse of *two days!* It had in fact been removed from the spot, washed, dressed in grave-clothes, and put into a coffin, before they saw it. (Letter by Dr. Gordon, 'Med. Times and Gaz.,' May 20, 1854, p. 525.) Thus the marks of gunpowder on one of the hands, generally found in suicide by pistols, were not seen here; and the removal of the body from the spot placed the medical men in a difficulty, since they could base their opinions only on the statements of ignorant witnesses. There were marks of blood on the ground, but these, it was suggested, might have been accidentally caused during the removal of the body. The situation of the wound, *i. e.* below the malar prominence in the cheek, is rather unusual for an act of suicide, but it was such as a murderer walking by the side of the deceased could have easily selected. The distance at which the pistol was held appears to have been greater than we find in cases of suicide; for had it been close, as it usually is in suicide, there would have been marks of extensive burning and laceration of the soft parts about the wound. The position of the pistol with respect to the dead body, as described by the witnesses who found it, is inconsistent with the supposition that deceased had thus fallen accidentally after having himself discharged the pistol. There was no motive for suicide, and no reason why, had suicide been contemplated, the deceased should have selected the prisoner's field for perpetrating the act. Deceased had been seen transacting business within half an hour of the time at which he must have died; and it was stated by his friends that they had never seen him with a gun or pistol in his possession, and had never known him to use fire-arms. Every fact, medical and moral, tended to prove that this was an act of homicide, and not one of suicide: further, there was no mark of struggling or scuffling, and no robbery had been perpetrated. The motive suggested by the prosecution against the prisoner, was based on the fact that he had recently effected insurances to the amount of about two thousand pounds, in three different offices, upon the life of the deceased, without having any pecuniary interest to justify the act. The insurances were for short periods, and it appears to be the practice in the Scotch offices that the policy is not rendered void by the act of suicide. It is important to state, as a supposed motive for the act, that the risk connected with the largest insurance (for one thousand pounds) commenced on the 24th November 1852, and terminated on the 24th November 1853. Only one premium to the amount of about eleven pounds had been paid, and this payment was proved to have been made by the prisoner Smith. The deceased was found dead on the 20th November, *i.e.* only four days before the date at which the policy of insurance upon his life would have lapsed. The accused had thus the motive, means, and opportunity of committing the crime, but there were no circumstances which could directly connect him with it. The early interference with the body, and the neglect to call for a medical investigation, probably led to the obliteration of parts of the evidence which would have clearly satisfied the jury that this could not have been an act of suicide.

Accidental gunshot wounds bear the characters of near wounds:—they may touch vital parts, but, if the body has not been disturbed, the presence or absence of design in the infliction of a wound is commonly made apparent by the relative position of the body and the weapon. They frequently arise from persons drawing the charges of guns or pistols with the muzzles pointed towards them, and they are then situated in front:—at other times they are produced by persons pulling towards them through a hedge, or dragging after them, a loaded gun. In the latter case the wound is behind, and it may strongly resemble a homicidal wound, although the circumstances under which the body is found generally suffice to explain the matter. (See 'Ann. d'Hyg.' 1860, t. 1, p. 443.) In the following case of attempted suicide, the characters of the wound somewhat resembled those which are commonly imputed to homicide. In March 1844, a man was brought to Guy's Hospital, with a large ragged gunshot wound on the right side of the head, behind the angle of the jaw, and between it and the ear. No slugs or bullets could be found; the direction was from behind forwards and from above downwards. According to this man's statement, the pistol missed fire three times, but he succeeded in discharging it into his mouth at the fourth attempt. He lost a large quantity of blood, but after some time he walked to a table at the distance of five yards, reloaded the pistol, and discharged it at the back of his head in the situation described. Thus, then, there were in this case two wounds, one of them being apparently homicidal in its characters: and there was a power of locomotion after the first wound, in spite of great loss of blood. A gunshot wound in the mouth or temple would seldom be set down to accident, and yet attempts are occasionally made to ascribe to such wounds an accidental origin. The admission of a near wound in the temple occurring from accident, must depend entirely upon the circumstances proved. (See the case of *Reg.* v. *Tottenham*, Norwich Lent Assizes, 1845.)

In suicide there is commonly strong evidence of design: in accident all evidence of design is wanting. Suicides sometimes make use of extraordinary weapons, or use weapons in an extraordinary manner. In a case that was brought into St. Thomas's Hospital, some years since, a young man employed, for the purpose of shooting himself, the case of an Italian iron, in which he had filed a touch-hole. He used a marble for a bullet, and discharged the piece into his mouth. Guns are rarely used by suicides, and when they are employed, the marks of design are commonly apparent:—thus the gun is perhaps found to have been discharged by a piece of string attached to the trigger and connected with the deceased's foot. In one instance a man loaded a gun, and placed the stock and breech in a grate. He then deliberately lighted a fire in the grate, and sat opposite to the muzzle. When suicides destroy themselves by guns, the wounds are never situated behind. A wound in the back from a gun, indicates either accident or homicide. Important medical questions sometimes arise out of a case of this kind, for the circumstances under which a dead body so wounded is found, may entirely forbid the supposition of accident. In the case of *The King* v. *Adams*, tried at the Berkshire Assizes, 1836, in which the prisoner was charged with the murder of his father, the gunshot wound, which had caused death, was situated at the back of the head. No weapon was found near, hence there could be no doubt that this was an act of murder. The prisoner was acquitted; since, although he was seen running from the spot at or about the time of the murder, another gun was heard to be discharged from the same spot, about an hour afterwards; and it was impossible, from a medical examination of the wound, to say at what particular period it had been caused. A somewhat similar case occurred more recently (*The Queen* v. *Richards*, Warwick Lent Assizes, 1843). The deceased was found dead, lying on his back, with his gun placed on the front of his body, reaching from his thigh to some inches above his head. On inspection, it was ascertained that death had been caused by a severe gunshot wound at the back of the right ear. Two surgeons of Birmingham gave it as their opinion, that from the position of the wound, the body, and the weapon, death could not have occurred from design or accident on the part of the deceased, but might have taken place from the accident of another. The prisoner was acquitted, as there was insufficient proof to connect him with the act.

Position of the wounded person when shot.—Did the deceased receive the shot while standing, falling, or lying down? Was the piece, when discharged, pointed from the shoulder?—These questions can only be answered by reference to the particular circumstances of the case. In general, when a person is shot while standing, and the piece is pointed from the shoulder, the wound is more or less transverse; but due allowance must be made for the deflection of balls after penetration. (*The Queen* v. *Magarity*, Central Criminal Court, July 1841.)

Was the deceased shot while running away, or when approaching the person who fired?—This question is answered by observing, in the case of a traversing wound, in which alone any difficulty can arise, whether the entrance-orifice be situated in front or behind. A trial took place at the Kent Assizes, some years since, in which this question was material. An officer in the Preventive Service was charged with having caused the death of a man, by shooting him. The deceased was in company with a strong party of smugglers, whom the prisoner and his men were pursuing. During their retreat, the companions of the deceased fired on the Preventive Service men, and there seemed great reason to believe that he was accidentally killed by one of the shots so fired, as he was at the time between the pursuers and pursued. If, however, this had been the case, it was clear that he must have received the gunshot wound in front, as he himself was in the act of retreating. On the other hand, it was uncertain, from the general evidence, whether he had not been shot by the prisoner; because, although it did not appear that shots had been fired by him or any of his party, yet it was proved that in running he tripped and fell, and his gun went off at the same instant, so that it was not impossible that the deceased might have received the mortal wound in this manner. The whole case, therefore, rested on the medical evidence. Two surgeons were examined,—one for the prosecution, and the other for the defence. The witness who appeared for the prosecution deposed, that he found the body of the deceased traversed by a gunshot wound, which had caused death from the laceration of an artery, and the consequent hæmorrhage. One of the orifices of the wound was situated in the lower part of the buttock, and the other in the upper part of the groin, so that the latter was higher up than the former. He made an inspection of the body, and in his judgment the ball had passed through the bones of the pelvis, from behind. According to the opinion of this witness, therefore, the prisoner must have caused the death of the deceased. For the defence, a surgeon in the navy—who, it appeared, had had considerable experience relative to gunshot wounds—was called. He stated that he examined the body of the deceased in the presence of the first witness, but he was of opinion that the ball had entered in front, and passed out behind the body. The reasons which he assigned for this opinion were, that the wound in front was much smaller than that situated behind, and its edges were smooth and depressed, or turned inwards; while the opening behind was twice or three times the size of that before, and was ragged and uneven—the fragments of bone lying about the opening, and being partly lodged in the muscles of the buttock. These facts proved to him, most unequivocally, that the ball had entered in front, having, with diminished impetus, torn itself out posteriorly. If the ball had entered from behind, he should have expected that the fragments of bone would not have been carried upwards and inwards into the pelvis, and would not have been lodged about the buttock. The value of this witness's evidence was most materially affected by the cross-examination which he underwent. He then stated, that he did not make an inspection of the body until after it had been already inspected, and sewn up. He did not see the state of the bone itself, and his examination of it was but slight. He admitted that the openings of the wound afforded better evidence than the state of the bone, as also that the bone would certainly be shattered where the ball had entered. They both agreed, in the first instance, that the ball had entered in front. No reason was assigned why his evidence afterwards differed so materially from that of his colleague. Dr. Smith, who reports this case, does not say what was the result, and we are, therefore, left in doubt upon which of the two witnesses' opinions the verdict of the jury was based; but if it was found that the prisoner had been the cause of the death of the man, it would have been, upon the evidence, no more than misadventure. The view of the latter witness was most probably correct, namely, that the ball had entered in front, and that the deceased was shot by his own party—because the reasons assigned by him were satisfactory and consistent with general experience on the subject; but his opinion was invalidated by the admission that he had made but a superficial and imperfect examination of the body, as also that he did not see it until after it had been inspected, and, therefore, not until the parts had been interfered with by others. The direction of the wound—its passing from above downwards, and from before backwards—also throws a shade of doubt upon its correctness; since, for the shot to have been fired in front, the individual who fired it must have been much elevated above the deceased (a circumstance which did not appear from the evidence), or a ball could not have taken such a course; while, on the other hand, its direction was precisely such as it would have taken if it had been discharged from the prisoner's gun, since it was established by the evidence that he, the prisoner, had fallen, while pursuing, and his gun had become then accidentally discharged. (Smith's 'Forensic Medicine,' p. 290.)

Wounds from small-shot.—Death is sometimes occasioned by small-shot, and here several medico-legal questions present themselves. Small-shot may act in two ways:—1. It either strikes without spreading, in which case the discharge is always near the person, and its action is much more dangerous than that of a single ball, because it produces extensive lacerations; or 2. It strikes after it has spread, and here the discharge must have been distant, and comparatively little mischief is done. Dr. Lachèse ascertained, by many experiments on dead bodies, that in order to produce with small-shot a round opening, somewhat resembling that produced by a bullet, the discharge should take place point-blank at the distance of about ten or twelve inches from the surface of the body. When the distance was from twelve to eighteen inches, the opening made was irregular, and the borders were much lacerated; at thirty-six inches, a central opening was entirely lost, and the surface of the body was covered by shot. The effect after this was found to depend on the distance, the goodness of the gun, and the strength of the charge ('Ann. d'Hyg.,' 1836, p. 386): but the shot is, in general, much scattered over the surface of the body. From these results we may form an opinion of the distance at which the piece was fired. In *The Queen* v. *Chapman* (Oxford Lent Assizes, 1839), it was proved that the deceased had been killed by small-shot fired from a gun; that the discharge must have taken place very near, as the shot had not been scattered, and the point of the gun must have been below the level of the wound, as the direction was rather upwards. Two medical witnesses were examined, and both agreed that, judging from the direction of the wound, the gun when fired could not have been pointed from the shoulder. A similar question was raised in *Reg.* v. *Hull* (Oxford Summer Assizes, 1846), and it was decided that the discharge of the gun took place accidentally during a struggle. The case of *The Queen* v. *Kendrew* (York Winter Assizes, 1844) is in this respect of some medico-legal importance. The medical evidence was very satisfactory. It was shown to be highly improbable that deceased could have shot himself with small-shot from a gun, as the shot were scattered, and there was no round opening or mark of burning. It is difficult to conceive that small-shot can, under any circumstances, produce a single entrance-wound, having some appearance of circularity about it, without at the same time singeing or burning the skin or dress. The difficulty of laying down any general rules respecting the wounds produced by small-shot at their entrance and exit, will be apparent from the following facts, communicated to me recently by two medical gentlemen.. A boy was shot in the neck by the accidental discharge of his gun, loaded with an ounce of No. 8 shot. He died instantly. He was leaning forwards on the muzzle, so that it was nearly in contact with the skin of the neck. A large round hole was produced, one inch and a-half in diameter, the edges of which were slightly blackened with powder. The exit-aperture, which was at the back of the neck a little to the left of the third cervical vertebra, was a mere slit in the skin, scarcely an inch long, with the long diameter placed vertically. The smallness of this aperture may have been owing to the greater part of the charge being lodged in the body. The entrance-aperture, although rounded, was too large to be mistaken for a bullet-wound: it was evidently a near wound, from the blackening of the edges. On the other hand, Dr. Lowe informs me that in some experiments performed by his brother, it was found that a round aperture might be produced by a discharge of small-shot at a much greater distance from the object than that assigned by Dr. Lachèse. A new gun was fired with the usual charge at a sheet of paper placed at sixty paces' distance. A circular hole was produced in the centre of the sheet, through which apparently every shot had passed. The hole was slightly jagged at the edge, but otherwise resembled that made by a bullet. My informant believes that new guns with highly polished surfaces throw the shot very closely together, and that this is the explanation of the difference in the results obtained by him and those described by Dr. Lachèse. Admitting such exceptional instances, and assuming the general correctness of the inferences drawn by Dr. Lachèse, from the results of his experiments in discharging small-shot at dead bodies placed at different distances, it does not seem probable that a wound from small-shot can, under any circumstances, be mistaken for one produced by a leaden *bullet.* This question, however, arose in a case tried by Parke, B. (*Reg.* v. *Spriggs*, Lewes Lent Assizes, 1854), in which the prisoner was charged, upon his own statement, with having caused the death of his wife by discharging at her a loaded gun. When seen shortly after by the medical witness, deceased was quite dead. There was a 'jagged' wound upon her forehead, about an inch above the right eyebrow. The witness described it as a wound which, from its appearance, might have been produced by any blunt instrument, or by a gun fired from a short distance! On further examination it was found that the back part of the head had been driven in (?), and it appeared as though the shot had passed completely through the head and brain, passing out behind in a direction slanting downwards, the wound behind being three inches lower than that in front. He did not see any shot, nor did he open the head to endeavour to find any; but a portion of the skull and hair had been driven into the wound. The learned judge properly suggested that the brain should have been examined, as some shot might have remained there; and this would have shown exactly how the mortal injury had been produced. The medical witness was pressed to say whether he was certain the injury had been caused by shot and not by a bullet. He said he was certain it was by shot, as he had had much experience on bullet-wounds in Ireland! Fortunately, there was good evidence to show that one barrel of the prisoner's gun had been discharged, and the undischarged barrel was found loaded with shot. The prisoner was convicted. There appears to have been no mark of burning or singeing of the hair or dress in this case, or the witness would not have suggested that the wound might have been occasioned by a blunt instrument. Considering that there were two penetrating wounds on opposite sides of the head, this was a singular part of the evidence. It is clear that there was one great central wound (the entrance-wound), which although described as 'jagged,' appeared difficult to be accounted for, as no shot were scattered or could be found in the skin. Yet this single wound was obviously caused by small-shot. In all similar cases, it would be proper to examine the track of a wound throughout. According to Lachèse's experiments it is probable that the piece was in this case discharged within twelve to eighteen inches from the surface of the skin.

A discharge of small-shot, in contact with the skin or close to it, will however produce, not a round opening, but a severe lacerated wound. In the case of a gentleman of the Scotch bar, an accidental gunshot wound in the leg occurred under the following circumstances. He had, during a sporting excursion, lain down on the grass and fallen asleep, the muzzle of his gun being close to the back of the calf of his left leg, and pointing in a slanting direction downwards. By some accident the gun went off, and the shot produced a complete laceration of the whole of the fleshy part of the leg, with no appearance of a round perforation. As might be expected from the closeness of the discharge, the leg of his trousers was much burnt as well as cut and torn. Although, according to Dr. Lachèse's experiments, a round opening may be produced by small-shot when the piece is fired at the distance of a foot from the body, the above case clearly proves that the shot may be scattered, and an extensively lacerated wound caused, when the muzzle is close to the skin, and the piece is not discharged point-blank. The scattering of the shot, however, in such a case, could not lead to the inference that the discharge had taken place from a distance, because the skin and dress would always present distinct marks of burning.

Small-shot is rarely observed to traverse the body entirely unless discharged so near as to make a clean round opening; but a single pellet reaching the body may destroy life. There may be no exit-aperture, or it may be smaller than that of entrance. Two cases have already been mentioned; one in which a young man was killed by a single pellet wounding the fifth intercostal artery; the other, in which a girl was killed by a pellet traversing the orbitar plate and wounding the brain. Such minute wounds might be easily overlooked in the examination of a dead body. Small-shot, even when wounding only the skin of the back superficially, has been known to cause death by tetanus.

Wounds from wadding and gunpowder.—It matters not with what the piece is charged,—it is capable, when fired near, of producing a wound which may prove fatal. Thus a gun loaded with wadding, or even with gunpowder only, may cause death. In these cases, an impulsive force is given by the explosion, and the substance becomes a dangerous projectile. The lighter the projectile,—the shorter the distance to which it is carried; but when discharged near to the body, it may produce a fatal penetrating wound. A portion of the dress may be carried into the wound, and lead to death from bleeding: or if the wounded person recover from the first effects, he may subsequently sink under an attack of tetanus or erysipelas. It is unfortunate that so much ignorance prevails on this point: for fatal accidents frequently occur from persons discharging guns at others in sport,—an act which they think they may perform without danger, because they are not loaded with ball or shot. In the *Queen* v. *Race* (Bury Lent Assizes, March 1840), it was proved that the prisoner had killed the deceased by discharging at him, within a few feet, a gun loaded with powder and paper-wadding. The deceased fell, and died in a few minutes. It was found that the chest was penetrated, and that the wadding had wounded the left auricle of the heart. (See 'Ann. d'Hyg.' 1859, vol. 1, p. 421.) In 1838, a girl was killed at Burton-upon-Trent, by a boy who discharged at her a gun loaded with paper-pellets. Some of these penetrated the body, and lodged in the lungs and liver. Dupuytren mentions an instance, where, during a quarrel between two men, one discharged at the other a gun loaded with powder and wadding only, at a distance of about eighteen inches. The man instantly fell dead:—on inspection, his clothes were found torn,—the intestines were lacerated, blood was effused, and the wadding was lodged in the abdomen.

It has been observed, that persons in attempting to commit suicide have occasionally forgotten to put a bullet into the pistol; nevertheless, the discharge of a piece into the mouth has sufficed, from the effect of the wadding only, to produce a considerable destruction of parts, and to cause a serious loss of blood. Fatal accidents have frequently taken place from the discharge of wadding from cannon during reviews. It is not easy to say at what distance a weapon thus charged with wadding and powder would cease to produce mischief, since this must depend on the impulsive force given by the powder, and on the size of the piece. Dr. Lachèse has ascertained by experiment, that a piece charged with gunpowder, is capable of producing a penetrating wound somewhat resembling that caused by small-shot, when the piece is large, strongly charged, and fired within six inches of the surface of the body. ('Ann d'Hyg.' 1836, p. 368.) This arises from a portion of the powder always escaping combustion at the time of discharge, and each grain then acts like a pellet of small-shot. Under any circumstances, a discharge of powder only, contuses the skin, producing ecchymosis, and often lacerating it, if the piece be fired near. The dress is burnt and the skin scorched from the globe of flame formed by the combustion of the powder; many particles of gunpowder may be actually driven into the true skin. All the substances here spoken of are considered to be projectiles; and the weapons are held in law to be loaded arms, so long as they are capable of producing bodily injury at the distance from which the piece containing them is discharged. It may therefore become a question as to the distance at which these light projectiles cease to be harmless. The answer must be governed by circumstances; but it will in all cases materially depend on the strength of the charge. In *Reg.* v. *Collier* (Abingdon Lent Assizes, 1844), the prisoner was charged with firing a gun loaded with small-shot at the prosecutor, with intent to do grievous bodily harm. It appeared that the gun was deliberately pointed at the prosecutor, who was then at a distance of from seventy to eighty yards from the prisoner. The shot, which was very small, had marked the clothes, but had not penetrated the skin or inflicted any wound. The defence was, that, from the slight injury done, the prisoner merely intended to frighten the prosecutor, and not to do him any bodily harm. He was found guilty of a common assault. The question was here a delicate one, for had the prosecutor been a few yards nearer, and the pellets touched an exposed part of his body, the result might have been serious. One pellet has destroyed life (p. 387). A case occurred, in the United States, involving the question as to the distance at which a pistol *not* loaded with ball would suffice to produce a serious wound. A boy, in play, discharged a pistol at a companion, producing on the fleshy part of the left hip a wound one inch in diameter and four inches in depth. The skin was destroyed, and the muscles presented a blackened lacerated mass. There was no ball in the pistol; but it is not certain whether there was wadding. Death took place from tetanus on the seventh day; and on examination, no wadding was found in the wound. There were, however, grains of gunpowder, with which the wound was blackened throughout its whole extent. At the inquest the witnesses differed respecting the distance at which the pistol was held when the wound was inflicted. Some said one foot; others two or three yards. The deceased had stated his belief that the pistol had almost touched him, and, judging by the state of the wounded parts, this was probably the truth. Dr. Swift contended that the wound had been produced by gunpowder only, without wadding. He performed some experiments with the pistol used by the prisoner, but loaded with gunpowder and *wadding*, in order to determine the effect of the discharges at different distances. At twelve inches distance from a body, he found that the clothes were lacerated and the skin abraded, but the wadding did not penetrate; at six inches, the clothes were lacerated, and the wadding penetrated to the depth of half an inch; at two inches, the wound produced, which was two inches deep, was ragged and blackened; at one and a half inch from the chest, the wadding passed into the cavity between the ribs, and in a second experiment it carried away a portion of a rib. ('Med. Gaz.,' vol. 40, p. 734.) These results confirm those obtained by Dr. Lachèse (p. 576).

Identity from the flash of gunpowder.—Among the singular questions which have arisen out of this subject, is the following:—Whether a person who fires a gun or pistol at another during a dark night, can be identified by means of the light produced in the discharge? This question was first referred to the class of Physical Sciences in France, in 1809, and they answered it in the negative. A case tending to show that their decision was erroneous was subsequently reported by Foderè. A woman positively swore that she saw the face of a person, who fired at another during the night, surrounded by a kind of glory, and that she was thereby enabled to identify the prisoner. This statement was confirmed by the deposition of the wounded party. Desgranges, of Lyons, performed many experiments on this subject, and he concluded that on a dark night, and away from every source of light, the person who had fired the gun might be identified within a moderate distance. If the flash was very strong, the smoke very dense, and the distance great, the person firing the piece could not be identified. The question was raised in this country, in the case of the *Queen* v. *White*, at the Croydon Autumn Assizes, 1839. A gentleman was shot at while driving home in his gig during a dark night; he was wounded in the elbow. When he observed the flash of the gun, he saw that the piece was levelled towards him, and the light of the flash enabled him to recognize at once the features of the accused:—in cross examination he said he was quite sure he could see the prisoner, and that he was not mistaken as to his identity. The accused was skilfully defended, and he was acquitted. Evidence of this kind has, however, been received in an English Court of Law. A similar case was tried at the Lewes Lent Assizes, 1862 (*Reg.* v. *Stapley*). The prisoner shot at the prosecutor, a gamekeeper, on a dark evening in December, and the latter swore that he distinctly saw the prisoner by the flash of the gun, and could identify him by the light on his features. His evidence was corroborated by three other witnesses, who saw him not far from the spot, and by one who saw him in the act of running away. He was convicted. A case is quoted by Paris and

Fonblanque (*Rex* v. *Haines*), in which some police-officers were shot at by a highwayman during a dark night. One of the officers stated that he could distinctly see, from the flash of the pistol, that the robber rode a dark-brown horse of a remarkable shape in the head and shoulders; and that he had since identified the horse at a stable in London. He also perceived, by the same flash of light, that the person had on a rough brown great coat. This evidence was considered to be satisfactory.

From the information which I have been able to collect on this point, it appears to me there can be no doubt that an assailant may be thus occasionally identified. It is widely different, however, in respect to the following case referred to by Müller, in his Physiology; namely, where a man declared that he recognized a robber through the light produced by a blow on his eye in the dark! As Müller observes, this is a clear impossibility; because the flashes thus perceived are unattended with the emission of light, and therefore can never be visible to any other person than the subject of them, and it is not possible that they can ever make other objects visible. [For some remarks on this subject by Dr. Schilbach, see Henke's 'Zeitschrift der S. A.' 1842, vol. 1, p. 197.] Dr. Krügelstein has lately opposed the inference deduced by Müller, and has supported his views by cases, which, however, do not appear to me to be satisfactory. (Henke's 'Zeitschrift der S. A.' 1845, vol. 3, p. 172.)

For a description of the chemical examination of firearms, to determine whether they have been recently discharged or not, the reader is referred to p. 434.

CHAPTER 48.

DEATH FROM BURNS AND SCALDS—SYMPTOMS—STUPOR—CAUSE OF DEATH—POST-MORTEM APPEARANCES—BURNS ON THE DEAD BODY—ACCIDENT, HOMICIDE, OR SUICIDE—WOUNDS CAUSED BY FIRE—SCALDING—BURNS BY CORROSIVE LIQUIDS.

Burns and scalds.—A *burn* is an injury produced by the application of a heated substance to the surface of the body; while a *scald* results from the application of a liquid at or near its boiling point, under the same circumstances. There seems to be no real distinction between a burn and a scald as to the effects produced on the body:—the injury resulting from boiling mercury or melted lead might take either appellation. Nevertheless, as a matter of medical evidence, it may be important to state whether the injury found on a body was caused by such a liquid as boiling water, or by a heated solid. If the former, the injury might be ascribed to accident; if the latter, to criminal design. A scald produced by boiling water would be indicated by a sodden state of the skin and flesh, but there would be no destruction of substance. In a burn by a heated solid, the parts may be more or less destroyed, or even charred: the cuticle may be found blackened, dry, almost of a horny consistency, and presenting a shrivelled appearance. This distinction would only apply to scalds from water. A scald from melted lead could not be distinguished from a burn produced by a solid heated to the same temperature. Some of the oils boil at 500°, and they produce by contact with the skin, burns as severe as those caused by melted metals. Burns from flame such as that of gas are indicated by extensive scorching of the skin, while burns from gunpowder are known not only by the scorching, but by the small particles of unburnt carbon which are imbedded in the skin.

Action of melted metals.—A singular case in which an attempt on life was made by pouring a melted metal into the ear, occurred to M. Boys de Loury.

The mother of an idiot, aged twenty-five, wishing to get rid of him, adopted the plan of pouring melted pewter into his right ear while he was lying asleep. Great pain and violent inflammation followed, but the young man recovered. The mother then alleged that he had himself poured the melted metal into his ear. At a judicial investigation, M. Boys de Loury was required to say whether such an act was likely to occasion death, and if so, how it happened that the party had in this instance recovered. The alloy was formed of seven parts of tin and three of lead, and the melting point of such an alloy would be about 340°. M. de Loury stated that such an act might lead to death, by causing inflammation and disease of the bones of the internal ear extending to the brain. The recovery of the youth was owing to the mischief which followed having been comparatively slight. In performing some experiments on the dead body, he found that it was difficult to fill the ear-passage with such an alloy, in consequence of the sudden expansion of the air caused by the high temperature. ('Ann. d'Hyg.' 1847, vol. 2, p. 424.)

Various degrees of burns.—Dupuytren has divided burns into six degrees, which are commonly recognized by medical jurists:—

1. The heat produces a simple inflammation of the skin without vesication. The skin is red, but the redness disappears on pressure: there is slight and superficial swelling, with severe pain, relieved by the contact of cold substances. The inflammation subsides after a few hours, and the skin resumes its natural condition:—or it may continue for several days, and the cuticle then peels off.

2. There is a severe inflammation of the skin, and the cuticle is raised into blisters containing a yellow-coloured serum. This kind of injury is generally the result of the action of boiling liquids. Some blisters are formed *immediately*; others are produced during a period of twenty-four hours, and those which are already formed become enlarged. Suppuration takes place if the cuticle is removed, and the person survives for a period sufficiently long. As the cutis or true skin is not destroyed by this degree of burn, there is no mark or cicatrix left on healing to indicate its past existence.

3. The superficial part of the cutis is destroyed. The burn appears in the form of yellow or brown patches, insensible when gently touched, but giving pain when strongly pressed. An inflammatory redness, accompanied by vesication or blistering, is perceived in the healthy portion of skin around the eschars. A white and shining cicatrix, without contraction of parts, remains after healing. This degree of injury is commonly observed in burns from gunpowder, and the part which was the seat of the burn is frequently stained black, when the particles of gunpowder have not been removed soon after the accident.

4. The skin is destroyed as far as the cellular tissue beneath. There are firm and thick eschars (dead portions of skin), which are quite insensible. If the burn has arisen from a boiling liquid, the eschars are soft and of a yellowish colour; if from a red-hot solid, they are firm, hard, and of a brown colour—sometimes black. The skin appears shrivelled and puckered towards the eschar, which is depressed below the surface. The surrounding skin presents a high degree of inflammation, and vesications appear. From the fourth to the sixth day, the eschar falls off, leaving an ulcerated surface which heals slowly, and is always indicated by a cicatrix.

5. In the fifth degree, the whole of the layers of the skin, the cellular membrane, and a portion of the muscles beneath, are converted into a general eschar. The appearances are similar to those of the fourth degree, but in a more aggravated form.

6. The burnt part is completely charred. If the person survives, violent inflammation is set up in the subjacent tissues and organs.

Neither a burn nor a scald appears to be considered as a *wound* in law; but in the statute of wounding they are included among bodily injuries dangerous to life. Burns and scalds may be regarded as dangerous in proportion to the extent of surface (of skin) which they cover, as well as the depth to which they extend. The extent of surface involved in a superficial burn, as a result of exposure to flame, is of greater importance than the entire destruction of a small part of the body through an intensely heated solid. When the burn is extensive, death may ensue either from the intensity of the pain produced, or from a sympathetic shock to the nervous system. Death takes place rapidly from burns in children and nervous females: but in adults and old persons, there is a better chance of recovery.

Symptoms. Stupor from burns.—In some instances, especially in children, stupor and insensibility have supervened, owing to sympathy with the brain; and these symptoms have been followed by coma and death. If, under these circumstances, opium has been given to the patient as a sedative, the stupor resulting from a burn may be attributed to the effects of the drug; and should the person die, the practitioner may find himself involved in a charge of malapraxis. It may be alleged, as in the following case related by Mr. Abernethy, that the person was poisoned by opium. A medical man was charged with the manslaughter of a child by giving to it an overdose of opium, while it was labouring under the effects of a severe scald. Mr. Abernethy stated in his evidence, which was given in favour of the practitioner, that he thought the exhibition of opium very proper:—that the quantity given, eight drops of tincture of opium immediately after the accident, and ten drops two hours afterwards, was not an overdose for a child (the age is not stated). The circumstance of the child continuing to sleep until it died, after the exhibition of the opium, was, in his judgment, no proof that it had been poisoned. This sleep was nothing more than the torpor into which it had been plunged by the accident. The surgeon was acquitted. Notwithstanding the favourable opinion expressed of this plan of treatment, it would be advisable to avoid the use of opium on these occasions in respect to infants and children. Life is readily destroyed in young subjects by the smallest doses of this drug (see p. 286); and there are no satisfactory means of distinguishing the comatose symptoms produced by a burn or scald from those produced by an overdose of opium.

Cause of death.—Of the cause of death in persons exposed to fire but little need be said. In large conflagrations persons are frequently simply suffocated, from the want of proper air or the respiration of the products of combustion—carbonic acid or carbonic oxide. The former darkens the blood; the latter renders it lighter in colour.

In other cases, where a large volume of flame suddenly falls upon the body and the person is still able to breathe, the fatal effect may be due to shock—a sudden and violent impression on the nervous system. A person may recover from the first effects of severe burns, but ultimately sink from exhaustion or from a sudden attack of tetanus. ('Med. Times and Gaz.,' April 26, 1854, p. 406.)

From a statistical report published in 1863 by the Registrar-General, it appears that in fourteen years (1848-61) 39,927 persons died from the effects of burns and scalds. Of this number 15,621 were children under five years of age.

Post-mortem appearances.—In examining the body of a person found burnt, all matters connected with sex and identity should be duly observed. Dr. Grünbaum has reported a case in which he was required to examine certain carbonized remains in which, in spite of the destruction of the sexual organs, he was able to determine the sex. (Horn's 'Vierteljahrschrift,' Oct. 1864,

p. 303.) The presence of a large quantity of phosphate of lime in the ashes would indicate animal remains; but the bones are never completely destroyed. They become white, and portions of them retain their form under the action of a most intense fire. When death has been caused by severe pain, no changes have been detected in the dead body; but, under other circumstances, it has been found on inspection that there were patches of redness on the bronchial mucous membrane, as well as on the alimentary canal. The brain has been found gorged, and the ventricles have contained an abundance of serosity. The serous liquids of the pericardium and pleura have also been in larger quantity than natural. In short, besides congestion, there is generally abundant serous effusion in one of the three great cavities, especially in the head. This arises from the sudden reflux of blood into the interior, as an effect of the local injury. (See case by Mr. Long, 'Med. Gaz.' vol. 25, p. 743; also, by Mr. Erichsen, vol. 31, p. 551.) In deaths from fires in houses the persons are usually suffocated, and there are the appearances of this kind of death (see SUFFOCATION). In a case in which a woman died on the thirteenth day from a superficial burn involving the skin of the lower part of her body, the stomach was found inflamed at its greater extremity, and the duodenum at its lower portion—the mucous folds of the intestines having a scarlet colour. The other intestines as far as the cœcum were also more or less inflamed. ('Amer. Jour. Med. Sciences,' Jan. 1861, p. 137.) If the person survives the first effects, he may die from inflammation, suppuration, gangrene, irritation, or fever, or he may be worn out by exhaustion. In this respect, burns of the fourth, fifth, and sixth degrees are especially dangerous to life; and it would be unsafe to give a premature opinion of the probable result, as inflammation of deep-seated viscera only appears after several days. In the cases of six children burnt to death in December 1862, Dr. Buzzard made the following observations. The eyelids were firmly closed—the limbs were contracted, and the hands clenched. The burns on the bodies of these children were of great superficial extent, but not deep. Nearly three-fourths of the surface of the body had suffered from the effects of fire, and in all the hands were very much burnt. In one of the bodies least injured by the fire he found the skin and coverings of the chest injected with blood of a bright red colour. The lungs were much congested, and also of a bright red colour. The cavities of the heart were empty. The brain was congested with red blood. He found no blood in the body presenting the usual characters of venous blood. He attributed death to the shock from sudden and extensive burns, and not to suffocation. (See 'Lancet,' 1863, vol. 1, p. 60.) In a case of death from burning examined by the late Mr. Jackson of Stamford, in 1860, the lungs were congested, and the cavities of the heart were empty. No particular observation was made as to the colour of the blood. The tongue was swollen, and there were some other appearances indicative of strangulation; so that the burning had probably been resorted to in order to conceal the mode of death. There was a blister or vesication on the top of the chest, showing that when the body was burnt it retained some degree of vitality. The eyes were much suffused. The principal subject on which medical evidence is required on these occasions is in reference to the question whether, in a dead body found burnt, the burning took place during life or after death. As bodies are sometimes burnt in order to conceal other acts of violence, a careful inspection should be made to determine whether there are indications of any other kind of violence. The power to answer these questions must depend on the degree to which the action of the fire has been carried. The remains may be so charred as to render all such enquiries nugatory.

Did the burning take place before or after death?—Vesication.—The production of *vesication* or of *blisters* containing serum, is commonly regarded as an essential character of a burn which has been produced during life, but it is not a necessary or invariable effect of a burn on the living body. Vesication is especially observed in scalds, or in those cases in which the skin has been burnt by flame or by the ignition of the clothes, provided the cuticle has not been destroyed. It is not so commonly observed in burns produced by intensely heated solids. In vesication, the cuticle is raised from the true skin beneath, and is converted into one or more blisters containing serum, while the skin around is of a deep-red colour. It is uncertain as to the time at which it appears; it may be produced in a *few minutes*, or sometimes not for several hours; hence death may take place before vesication occurs, and the non-discovery of this condition does not warrant the opinion that the burn could not have taken place during life. If the cuticle is removed from a vesicated part of the living body, the skin beneath will become intensely reddened, but if the cuticle is stripped off a dead body, the skin will become hard, dry, and of a horny-yellow colour; it does not acquire the intense scarlet injection which is acquired by the living skin when vesicated and exposed.

There have been conflicting opinions whether the presence of blisters (vesication) on a dead body should be received as proof of burning during life. The following may be taken as a summary of the facts hitherto ascertained. Dr. Christison, on one occasion, had an opportunity of trying experiments on the effects of dry heat on the same body before and after death; this was in the case of a young man who had poisoned himself with opium. While he was lying in a hopeless state of coma, four hours before death, a hot iron was held on the outside of the hip-joint; and half an hour after death, a red-hot poker was applied to three places on the inside of the arm. Vesication followed the burns in both instances; but those caused during life contained serum, and those which were formed after death, *air*. In another experiment, a cauterizing iron produced no blisters on a leg, half an hour after amputation; but vesications, containing air, were formed, when in another case the iron was applied ten minutes after amputation. On the whole, Dr. Christison thinks that a vesication containing serum indicates a burn during life, and one containing air, a burn after death. I have performed some experiments on the bodies of infants eighteen and twenty hours after death, both with boiling water and heated solids; but in no case have I observed any kind of vesication to follow at that period. The skin was shrivelled, and was partly destroyed by the heat, but there were no blisters produced. (See a paper by M. Ollivier, 'Ann. d'Hyg.' 1843, vol. 1, p. 383.) Under certain morbid states, blisters containing serum may be produced in the dead body, even twenty-four hours after death. M. Leuret observed that this took place in a dropsical subject, in the vicinity of which a heated brazier had been placed. The cuticle was hardened, then raised and blistered; and the blister contained an abundance of reddish coloured serum. In repeating this experiment on other dead bodies not infiltrated, it was observed that no vesications containing serum were produced. ('Ann. d'Hyg.' 1835, vol. 2, p. 387.) M. Champouillon has repeated the experiments of M. Leuret on bodies affected with general dropsy, and he finds that blisters may be produced in them at almost any period after death. Thus, they occurred when heat was applied to one recently dead,—to another when in a state of cadaveric rigidity, and to a third when putrefaction had commenced. The blisters did not appear immediately,—the time which he found requisite for their production varied from two to six hours. The serum effused beneath the raised cuticle was rarely tinged with blood. ('Ann. d'Hyg.' 1846, vol. 1, p. 421.) These experiments only confirm the results previously obtained by M. Leuret; they add nothing to our knowledge of the subject. The conclusion to be drawn from them is, that in the examination of *burns* on the body of a person affected with general dropsy, it is necessary to be cautious in expressing an opinion. In such cases it would not be possible, from the existence of mere vesication, to say whether the burn took place before or after death.

The late Dr. Wright, of Birmingham, has published the results of some experiments on burning after death, from which he infers that the production of a *serous* blister, or a blister containing serum, in the dead body is not dependent on the presence of serum in the cellular tissue (anasarca), but upon the amount of (latent) organic life remaining in the body. He states that he has produced a serous blister in a dead body more than a dozen times,—twice within half an hour, and once within fifteen minutes after death; and in amputated limbs he has produced them in from half a minute to four minutes and a half after amputation. The only favourable opportunity which occurred to him for producing, after death, a serous blister, was in the person of a female thirty years of age, who died suffocated from acute congestion of the lungs. She was slightly dropsical. *Three hours and a half* after death, when the body was quite warm, and the joints were flexible, a spirit-lamp flame was applied to the lower and back part of the left leg. After the lapse of an hour, blisters had been formed, and were filled with serum of a pale straw-colour: one contained two and the other three drachms. Ten and fifteen hours after death, when the body had become cold and rigid, the flame produced only *gaseous* blisters. ('Pathological Researches on Vital and Post-mortem Burning,' 1850.) The results obtained by Dr. Liman in repeating these experiments on five dead bodies, in from one to two hours after death, are not in accordance with those described by Dr. Wright. Liman noticed that by a spirit-flame a blister might be raised, but that it contained nothing more than vapour derived from the fluids of the skin beneath the cuticle. It soon became flat and charred, and there were no changes in the surrounding skin indicative of vital reaction. The temperature (of the bodies) varied from 78° to 98°. No experiments were performed on the bodies of persons dying or just dead. (Casper's 'Vierteljahrschrift,' 1863, vol. 24, p. 367.) It is, therefore, exceedingly doubtful whether, except under special conditions of the body such as general dropsy, blisters containing serum can be produced by a burn on the skin of a person really dead. Dr. Christison found that when boiling water was poured upon a dead body *ten minutes* after death, the skin was simply ruffled and shrivelled; but the cuticle was not raised into a blister. The same effects were produced so long as the body retained its warmth. Accident has enabled me to describe the results within a shorter period than that above mentioned. The body of a drowned man, within a few minutes after the accident, was removed from the water and placed in a warm (hot?) bath. It was found impossible to resuscitate him, but owing to the great heat of the water, portions of the cuticle came off, when the body was removed. On inspection there were several vesications *filled with bloody serum* over a considerable portion of the skin, especially of the extremities. There was no anasarca here to account for their production; and the fact of their occurrence appears to bear out the view of Dr. Wright, that the production of a *serous* blister on a dead body depends on the amount of latent organic life remaining in it. In this case the man was pulseless, and to all appearance *dead*, when placed in the hot bath; hence the effects of *hot liquids* on the living and the recently dead body, so far as the production of vesication is concerned, are proved by this case to be similar. Dr. Chambert has lately published the results of numerous experiments on the effects of burns on the living and dead body. These have been made on the bodies of persons, from the moment of death until twenty hours after dissolution, and some were performed before death. The general results of his researches are, —that vesications, or blisters, may be produced by burns both on the living and dead body; that they are produced at a lower temperature in the living than in the dead; that in the living a burn produces great capillary congestion, with the effusion of serum in the blisters, and that this serum when heated, or treated with nitric acid, sets into a nearly solid coagulum. The blisters produced in a dead body, even a few minutes after death, contain a thin watery serum, which is only rendered opaline or milky by heat and the action of nitric acid. ('Ann. d'Hyg.' 1859, vol. 1, p. 342.)

A line of redness.—In burns, especially in those produced by red-hot solids, other effects besides vesication follow. The edge of the skin immediately around the part burnt is commonly of a dead white, and close to this is a *deep red line*, gradually shaded off into the surrounding skin, which is reddened. The diffused redness is removable by pressure, and disappears with life; the red line here referred to, however, is not removable by pressure, and is persistent after death. This line of redness is not always met with in severe burns, and when a person survives one or two days, its production appears to depend upon a power of reaction in the system. Thus, then, its absence furnishes no proof of the burn having been produced after death, for it is not a necessary accompaniment of a burn during life. Dr. Christison has endeavoured to determine by experiment whether this line of redness could be produced by applying a heated solid iron to a dead body. He found that when the person had been dead only *ten minutes*, no such effect was produced. In repeating his experiments on bodies many hours after death, I have found that no line of redness ever presented itself; so that its discovery in a dead body burnt, would appear to indicate either that the burning took place during life, or within ten minutes after death,—most probably the former. M. Champouillon takes exception to the inference derivable from these experiments. He says that he has caused the production of a line of redness by the application of heat to a dead body, and that it is a uniform accompaniment of the formation of blisters in the dead. He admits that it is in this case a mere capillary infiltration of blood, quite superficial, and surrounding the margin of the blister; while in the red line produced during life the tissues of the skin are deeply injected, and this line is evidently the result of vital reaction. (See 'Ann. d'Hyg.' vol. 1, p. 442.) It would appear that he has only remarked this condition in dead dropsical bodies, in which vesications had been produced, and it is obvious from his description, that he is referring to a slight congestion of the vessels, occasioned probably by the stagnation of the fluid portion of the blood in the superficial capillaries. It is altogether distinct from the line of redness described by Dr. Christison as a frequent consequence of severe burns. In the case of Mr. *Westwood* (June 1839), the fact of certain burns on the body having been produced during life was determined by Mr. French, from an observation of this sign. The deceased was found dead, with his skull extensively fractured, his throat cut, and his body burnt in various places. Mr. French, who gave evidence on this occasion, remarked that the burns were surrounded by a line of redness —that they were probably produced about the same time as the other injuries, but certainly while there was some vital action in the system. When, however, vesication and a line of redness are absent, we have no medical data on which to found an opinion,—whether the burn was caused before or after death. Dr. Wright considered that in a low state of vitality a line of redness might not be produced by a severe burn on the living body, and that more certain reliance may be placed on the red marks found beneath the blisters and crusts of vital burns. These latter were well marked when he found the line of redness itself indistinct. (Op. cit. p. 25.) The recent researches of Dr.

Chambert confirm this view. In a burn on a living person, if the skin has not been entirely charred and destroyed, the cutis will present a dotted or pointed redness,—these dots or points corresponding to the sudiparous (perspiratory) and hair-follicles. After complete death, the burn does not produce any such effect; the cutis is of a dead-white on its surface and in its substance. In one experiment performed ten minutes after death, there was no redness of the skin, either beneath the blisters or in the surrounding parts. ('Ann. d'Hyg.' 1859, vol. 1, p. 368.) This reddened or congested state of the bare skin is more constant than any other appearance, and forms at present the best criterion of the infliction of a burn on the living body. The medico-legal facts connected with burns on the living and the dead, underwent a minute scrutiny in a remarkable case of alleged matricide at Bridgenorth. (*Reg.* v. *Newton*, Shrewsbury Lent and Summer Assizes, 1849.)

In March 1848, I was consulted by Mr. C. L. Prince, of Uckfield, on a case of some interest in reference to the medical proofs of burns produced during life. Two persons were charged with the murder of a new-born child which had been secretly buried and only exhumed for inspection ten days after death. Independently of an incised wound on the arm, the edges of which were everted and retracted like a wound produced on the living body, the right leg presented the marks of burning. The cuticle was entirely destroyed over the greater part of the limb: the surface beneath had an intensely scarlet colour and was much injected. There was a red line of inflammation around its edge, particularly in the upper portion, and at the lower part of the scrotum there was a large vesicle filled with serum. From this condition of the parts, Mr. Prince very properly inferred that the child must have been living when these burns were inflicted. The lungs merely indicated that respiration had been imperfectly performed. It turned out subsequently, by the confession of the mother, that the child had been born alive, and that its body had been deliberately burnt by one of the accused parties. The child probably did not survive a quarter of an hour: a proof that the marks indicative of a vital burn, do not require a long period for their production.

When *several burns* are found on a dead body, it may be a question whether they were all produced at the same time. This is a point which can be determined only by observing whether any of them present signs of gangrenous separation, of suppuration, granulation, or other changes that take place in a living body after accidents of this kind. The witness may be asked, how long did the deceased survive the burn? A person may die in a few minutes or live some hours after receiving a most extensive burn; and yet there will be no change in the part burnt, to indicate when death actually took place. There may have been no time for inflammation or its consequences to become established. Suppuration generally follows vesication, and in severe cases it may occur on the second or third day; but often not until a later period. In regard to gangrene, this takes place when the vitality of a part burned is destroyed. The time of its occurrence is uncertain, but it sometimes very speedily follows the accident.

After a murder has been perpetrated, it is not uncommon for a criminal to attempt to dispose of the body by burning it. This occurred in the case of Mr. Paas (*King* v. *Cook*), likewise in the case of the *Queen* v. *Good*, and in another case at Leeds (Jan. 1843), where a mutilated body was found floating in a river with marks of burning about it. In general, the body is not burnt until all signs of life have disappeared; we shall therefore meet, in such cases, with nothing but the charring of dead flesh, so that no difficulty can exist in forming an opinion. When the burning is partial, and has probably taken place from a wilful ignition of the clothes, at or about the time of death, some caution is required in expressing an opinion, since marks of vesication and a line of redness are not always present in burns during life. It is by no means unusual, however, to find it stated in evidence, that blisters are a constant accompaniment of a burn in the living body! In the *Queen* v. *Taylor* (York Lent Assizes, 1842), the deceased was found dead with marks of strangulation on her neck, and her clothes were much burnt from her waist to the knees. She was lying across the hearth—the body was burnt as well as the upper and lower limbs and the neck; in the opinion of the medical witness, the burn on the neck could not have been produced by fire extending from the other parts of the body. In cross-examination he stated that the burns must have occurred after death: they could not have taken place before, nor at the time of death, because there was no vesication, and he had never seen a burn on a living person which was not followed by blistering! The prisoner was convicted, his counsel having failed to prove or render it probable that death was caused, as alleged, by accidental burning. The reader will find some remarks on the burning of the living and dead body, in the report of the trial of Dr. Webster for the murder of Dr. Parkman. (See Report by Dr. Stone, Boston, 1850.)

Accident, homicide, or suicide.—It is rare that murder is perpetrated by burning: the dead body is either burnt for the purpose of entirely destroying it, or the clothes are fired soon after a person has been killed, in order to conceal wounds or other violent means of death, and to make it appear as if the deceased had been accidentally destroyed by fire. Death by burning is either the result of accident or homicide, most commonly the former; but medical evidence may give rise to a suspicion of murder under two circumstances:—1. When it is evident that several parts of the body have been fired at the same time, and the burns are such as not readily to be explained by the same accident, or by the accidental ignition of the clothes. 2. When there are marks of homicidal violence on the body; but these marks, if we except fractures of the bones, may be easily effaced when the burn is extensive. *Accidental* deaths from this cause are very frequent among females and children. Out of 4,671 violent deaths in 1838–9, in the metropolis and the mining districts, there were 962 from burning, and 201 from scalding. In investigating a suspicious case, we must remember that the fact of a dead body not being found near a fire or any substance capable of causing ignition, does not justify an imputation of murder; since the deceased, unless disabled by intoxication, infirmity, or disease, has the power of running away from the fire after an accident, and may be found dead at a distance, without having been seen by any person. Homicidal burning cannot be established by medical evidence, so much as by that which is presumptive or circumstantial; but there are many medical questions which arise out of the circumstances under which a dead body is found burnt. Among reported cases, the two following may serve to illustrate the difficulties attending such investigations.

The first is that of a man of the name of *Gilchrist*, who was tried at Glasgow, for the murder of his wife. The prisoner and the deceased, according to the evidence, led a somewhat rambling dissipated life. On the evening of the alleged murder, the persons who lived on the floor above them stated that they heard a noise like that of two persons struggling, and afterwards a moaning as of one choking or bleeding to death. A smell of fire now became perceptible in the house, which was soon filled with smoke. The witnesses being alarmed, went down to the prisoner's apartment and demanded admission. After some delay he admitted them, and in doing so, appeared to them to have come out of an inner room, where he said he had been sleeping. On letting them in, he stumbled over the body of his wife, who lay in the outer apartment quite dead, kneeling before a chair, and very much burnt. The prisoner was accused of having murdered her, and then burnt the body to conceal the manner of death. In his defence, he alleged that he had gone to bed tired, and that he knew nothing of what had happened to his wife until awoke by his neighbours. He presumed that her clothes had caught fire while she was intoxicated, and that she was thus accidentally burnt. The medical witnesses who examined the body reported that they found it so much burnt that they could give no opinion of the cause of death. The prisoner was condemned and executed, the general evidence being against him, although the precise manner of his wife's death, as Dr. Duncan observes, was not proved even presumptively. In the second case, which occurred at Leith, Dr. Duncan was the chief medical witness. The general evidence was similar to that adduced in the case of *Gilchrist*, but stronger against the prisoner. It appears that he and his wife lived on bad terms. On the night of the alleged murder, the prisoner was in bed, when his wife returned home with a lighted candle and some whisky, which she had procured at a neighbour's. Some time after, a struggling was heard in the apartment, and when this had subsided, a smell of fire was perceived to issue from it. The neighbours now endeavoured to obtain admission by knocking at the prisoner's door, but he either could not or would not hear them. At last a man forced his way in, by breaking the window of the outer room. On entering, he found the room full of smoke, and something burning in a corner, over which he instantly threw a pitcher of water:—this proved to be the body of the deceased. Several persons now entered the inner room, where they found the prisoner either asleep or feigning to be so. On being roused, and told that his wife was dead, he expressed neither surprise nor sorrow; but coolly demanded by what authority his neighbours had broken into his house, and threatened to send for a constable. On an examination of the body, some parts were found completely carbonized by the action of the fire. On the face and extremities, however, the fire had not acted with such violence, and on these parts were found marks of vital reaction, indicating that the burning had taken place during life. Some spots were merely red and inflamed, others scorched to a hard transparent crust, but surrounded by a distinct redness: there were also many vesications filled with serum. From these appearances, the witnesses gave it as their opinion that the deceased had been burnt to death. The jury in this case returned a verdict of 'not proven,' considering probably that the deceased might have been accidentally burnt. Dr. Duncan remarks, in regard to these two cases, that the action of the fire was extremely violent and destructive, compared with the small quantity of combustible matter consumed; but by what standard this was measured we have no explanation. As the combustible material was reduced to ashes, and the time occupied in the burning was not known, such an opinion could be little more than a conjecture. In both, the burns must have been produced by the ignition of the clothes alone, since there was no trace of burning of the house or furniture in either. In the second case the deceased was found on the hearth with part of her clothes unburnt, and a chair from which she had fallen, quite entire. She was dead when the neighbours entered; and the body was discovered in the dark by the red light issuing from it. An important question was raised on the second trial, in reference to the opinion of the deceased having been burnt to death, namely, whether the redness and blisters, remarked on the edges of the scorched parts, might not have arisen immediately after strangling or some other cause of death than burning, during the period when a lingering vitality remains in the body, and when undoubtedly certain phenomena of a vital nature are frequently observed. The medical witnesses felt themselves unable to answer the question decisively, but they stated that they did not consider it at all probable that blisters could be produced on the body even immediately after death. ('Med. Gaz.' Vol. 8, 170. See case by M. Leuret, 'Ann. d'Hyg.' 1835, Vol. 2, p. 370.) In these two cases there can be no doubt that the fire had been applied to the clothing either wilfully or accidentally.

Wounds caused by fire.—On the discovery of wounds on a body caused by fire, it is necessary they should be closely examined, in order that a witness may be enabled to say whether they have been caused by cutting or other instruments *before* death by burning, or whether they are not simple mechanical results of the effects of fire on the skin. Mr. Curling communicated to me a case which will show the necessity for this enquiry. A boy, two years of age, was brought to the London Hospital, November 11th, 1840, so severely burnt on the face, neck, abdomen and extremities, that he survived the accident only three-quarters of an hour. It appeared that the stepmother, who had charge of the child, left him at home locked up in a room where there was a fire, while she went out. Some of the neighbours shortly afterwards hearing screams proceeding from the room, broke open the door, and discovered the child enveloped in flames, and its clothes on fire. The flames were immediately extinguished, and the boy was brought to the hospital. A suspicion of illtreatment having been excited by the appearance of wounds about the knees which were observed as soon as the child was admitted, and by the reported neglect and illusage of the child by the stepmother, the coroner directed an inspection to be made. The body was plump and well-formed. The skin in the burnt parts was deprived of cuticle and converted into a deep yellowish or blackish dry mass, which was very tense, hard, and easily torn. There were gaping wounds on both knees. On the right side, a fissure in the skin commenced about the middle of the thigh, and proceeded for two inches and three-quarters to the inside of the patella or knee-pan, where it became somewhat jagged, and making a sudden turn inwards passed to the extent of two inches towards the back of the joint. A transverse laceration of the skin, three-quarters of an inch in length, was observed on the front of the left thigh a little above the left knee; and another, which was also transverse and measured an inch and a half, was situated below, on the inner side of the joint. These fissures in the charred skin were all about three lines in width and two in depth, and exposed the fatty tissue beneath, which was white, and free from any effusion of blood. The edges of these fissures were not uneven, but they did not present the clean and smooth appearance usually observed in incised wounds. The vessels on the surface of the brain were full of blood, and the cortical structure appeared dark-coloured. The lungs were congested, but the heart contained little blood. The mucous membrane of the stomach presented a slight pinkish hue, but that of the intestinal canal was nearly white. From the absence of any trace of effusion of blood, the sound condition of the exposed adipose tissue, its exemption from the action of the fire, and the irregular character and appearance of the fissures, Mr. Curling concluded that they were not the result of wounds inflicted before the occurrence of the burn; he considered them to have been occasioned by the influence of heat, which had forcibly corrugated the skin and completely destroyed its elasticity, and the superficial layer of fatty tissue being closely adherent to it, necessarily gave way at the same time. In several places some small vessels containing blood were observed running across the fissures; these, being more tenacious than the fatty tissue, had not yielded with it. This appearance alone was sufficient to negative the supposition of the infliction of wounds by cutting instruments.

The production of the fissures might have been aided by the child's struggles immediately after the occurrence of the burn, but it did not appear that these were at all violent. The conclusion at which Mr. Curling arrived was justified by the facts; and the case is calculated to throw an important light on the accidental origin of fissures or wounds of the skin in cases of death from burns.

The conclusions which, it appears to me, we may draw from the foregoing statements, are:—1. That, as a general rule, when we discover marks of vesication, with effusion of serum, or a line of redness, or both, about a burnt part of the body, we are justified in saying that the burn has occurred during life. 2. That when these appearances are not met with, it by no means follows that the burn had not been produced in the living body; the affirmative evidence derived from such appearances being much stronger than the negative.

The subject of *scalding* scarcely requires a separate notice. A scald from boiling water would, when recent, be indicated by vesication and the sodden state of the skin. The living structures are not charred or destroyed as by the application of a red-hot solid. At the Liverpool Summer Assizes, 1847, a woman was convicted of throwing boiling water over her husband, with intent to maim him. (*Reg.* v. *King.*) In another case (*Reg.* v. *Blewitt*, Worcester Summer Assizes, 1847), the prisoner was convicted of the manslaughter of his wife by pouring over her the contents of a kettle of boiling water. At the Stafford Winter Assizes, 1859 (*Reg.* v. *Hill*), a man was convicted of feloniously casting boiling water over the prosecutor with intent to do him grievous bodily harm. The medical evidence was to the effect that the scalds were on the head, cheek, neck, and arm, and were of a dangerous character. A woman at Glasgow attempted to kill her husband by pouring boiling water over his genital organs while he was asleep in bed. He died, but his death could not be clearly traced to this cause. These are the only recent instances of criminal scalding which are reported.

BURNS BY CORROSIVE LIQUIDS.

Among the cases in which medical evidence is sometimes required, are those of throwing mineral acids, alkalies, or other corrosive liquids on the person. This crime was at one time prevalent, and until the recent alteration in the criminal law there was no adequate punishment for it (24 & 25 Vict. c. 100, s. 29). On one occasion, an assailant escaped a charge of felony, because it could not be considered, in law, that sulphuric acid was capable of producing a *wound*—the man having been indicted for wounding! This case clearly showed a strong necessity for some legal definition of a wound, as well as the uncertainty of medical opinions: for while one surgeon considered that the injury produced was a wound, another thought that it was not. The judges decided that it was not a wound within the meaning of the Act. (*The King* v. *Murrow*, Liverpool Autumn Assizes, 1835.) The statute above mentioned, while it punishes the offence, omits all reference to a definition of the word wound. The nature of the liquid thrown is merely defined, in general terms, to be 'any corrosive fluid or any destructive substance'—a point which will require medical evidence for its elucidation.

In common language, and according to the statute, the injury thus produced by a mineral acid such as oil of vitriol, is called a burn; but it is wholly different in its origin, as well as in its progress. I do not know that there has been a single instance in which such an injury has directly destroyed life; but great deformity and actual blindness have resulted. A medical man is sometimes required to distinguish these injuries from burns and scalds: this may be easily done, in the first instance, by the appearance of the part injured, as well as by the description of the first symptoms. The stain is brown when sulphuric acid has been used, and yellow when nitric or muriatic acid has been employed. The eschar or destroyed part is soft and not dry as in a burn from a heated solid. The skin touched by a concentrated acid is destroyed and sloughs away, to the extent of the part on which the corrosive liquid was applied, leaving a suppurating and granulating surface. There is no capillary congestion or redness of the skin around the injury as in a burn; but the colour of the injured part may throw some light upon the nature of the corrosive substance used. Thus, while oil of vitriol (sulphuric acid) produces dark-brown stains, aqua-fortis (nitric acid) produces yellow or yellow-brown stains on the skin. Articles of dress are also differently coloured by these acids. The period at which a person may recover from an injury of this kind depends on the degree and extent of the injury, and the part affected by the corrosive liquid. Although a person may not die from the direct effects of the acid, yet in certain irritable constitutions the inflammation which follows in deep-seated parts may prove fatal. In infants, or delicate nervous females, an extensive injury thus produced may readily destroy life. In one instance, sulphuric acid thrown on the face produced inflammation of the eye, for which bleeding was prescribed. The person died of phlebitis (inflammation of the vein), as the result of this bleeding (p. 495). In the case of Miss *Cashin*, for whom an escharotic liniment, containing nitric acid, was prescribed by a quack, there was no doubt that death was caused by the great local mischief produced by the application. The nature of the acid may be determined by applying wetted linen to the part when the injury is recent, and examining the liquid thus absorbed. In general, however, evidence is readily obtained by examining the spots or stains left on articles of clothing or furniture. Sulphuric acid is most commonly used: in a case which occurred at Guy's Hospital, nitric acid had been thrown at the person, and had led to the destruction of the sight of one eye. The caustic alkalies may also be used under these circumstances, as well as numerous other liquids, on which the only medical opinion required would be, whether the article employed should or should not be considered as a corrosive liquid or a destructive substance. To constitute a felony, it is not now necessary that the *person* should have sustained, from the act of throwing, any bodily injury. Unless vital reaction has taken place, there are no means of distinguishing the effects of a corrosive liquid on the living from those produced on the dead body. ('Ann. d'Hyg.' 1859, vol. 1, p. 396.)

The mineral acids are sometimes used in other ways for the destruction of life. In June 1833, a man poured a quantity of strong nitric acid into the ear of his wife while she was lying asleep. She awoke suddenly with a violent pain in the ear, which continued for three days, whereby she became weak and exhausted. Soon afterwards there was copious bleeding, and a portion of membrane escaped. She lost the use of her right arm, and became completely deaf. Suppuration took place from the ear, and blood escaped daily. She gradually sank, and died six weeks after the injury, the right half of the body being convulsed before death. On inspection, a portion of the external ear was wanting, and the ear-passage was much wider than natural. The brain, near the petrous portion of the temporal bone, was softened, and the bone itself diseased (carious). The injury had led to death indirectly by producing disease of the brain. ('Med. Gaz.,' vol. 17, p. 89.)

In a case tried at Aberdeen, a woman poured oil of vitriol down the throat of her husband, while he was lying asleep with his mouth open. She was tried, and convicted of the murder (p. 167). In a more recent case, a woman killed her husband by pouring a solution of corrosive-sublimate down his throat while he was sleeping. These, however, were treated as cases of poisoning, as death did not depend on the local or *external* mischief produced by the corrosive agent employed.

CHAPTER 49.

SPONTANEOUS COMBUSTION—ALLEGED OCCURRENCE OF CASES IN HUMAN BEINGS—ACCIDENTS BY FIRE—SPONTANEOUS COMBUSTION OF VEGETABLE AND MINERAL SUBSTANCES—CONDITIONS FOR THE SPONTANEOUS COMBUSTION OF COTTON, HAY, AND OTHER SUBSTANCES—INFLUENCE OF OIL AND WATER—ALLEGED IGNITION OF FLAX, HEMP, AND JUTE—CASES REQUIRING SCIENTIFIC EVIDENCE.

It is nearly a century and a half since the hypothesis of the spontaneous combustion of the human body took its origin. It was readily accepted by those who could not in any other way account for the phenomena, and who were either incompetent or unwilling to reason correctly from recorded facts. At this date the facts connected with combustion, and the elements upon which it depends, had not even been discovered. All bodies were supposed to hold within them a principle of fire (*phlogiston*), which might be eliminated from them under certain conditions. When a person was found burnt, and no cause was apparent, the fire was supposed to have had a spontaneous origin, *i.e.* within the body of the deceased, and thus to have spread from the body to surrounding objects.

In medico-legal works cases are recorded, generally of ancient date, in which it was supposed that the body was spontaneously consumed by inward combustion. In one of the earliest of these cases, that of a man of the name of *Millet*, of Rheims, who was charged with the murder of his wife by fire, the question of spontaneous combustion was raised in the defence and led to the acquittal of the accused. This case rests upon the authority of Le Cat, and it is stated to have occurred at Rheims in 1725. It appears that the body of the deceased woman, almost entirely consumed, was found lying in the kitchen of the house at a short distance from the hearth. A part of the head only, with a portion of the legs, and a few of the vertebræ, had escaped combustion. The floor beneath the body was partially burnt. The prisoner, in his defence, stated that he and his wife had retired to rest on the previous evening; that his wife, not being able to sleep, got up and went into the kitchen, as he supposed, to warm herself. He was awakened by the smell of fire, and going down into the kitchen discovered the deceased lying near the hearth in the manner described. An alleged intrigue with a female servant was considered to furnish a sufficient motive for the supposed act of murder, and the man was found guilty. On appeal to a higher court, the sentence of death was revoked, and the prisoner was discharged on the ground that this was a case of spontaneous combustion. (Taylor's 'Elements of Medical Jurisprudence,' 1836, vol. 1, p. 254. See also Liebig's 'Letters on Chemistry,' 1851, p. 281.) As far as the mode of death was concerned there was nothing in this case to indicate violence by another. The facts are explicable on the supposition that the clothes of the deceased were accidentally ignited. The almost complete destruction of the body appeared at that date to be inconsistent with the ordinary effects of fire, but subsequent observations have shown that this is an error. At the same time it is not improbable that the amount of destruction of the body was exaggerated. Other cases, in which the details are similar, have been recorded. It does not appear, however, that any one on whose judgment reliance can be placed, has ever seen a case or recorded the details from actual observation. The hypothesis of such a mode of destruction of the human body is not only unsupported by any credible facts, but is as wholly inconsistent with all that science has revealed as witchcraft itself. In the instances reported which are worthy of any credit, a candle, a fire, or some other ignited body has been at hand, and the accidental kindling of the clothes of the deceased was highly probable, if not absolutely certain. It is in vain that they who adopt this hypothesis appeal to the electrical state of the atmosphere or of the individual, coupled with the impregnation of the tissues with the inflammable principles of alcohol, as conditions sufficiently explanatory of their views: such explanations may be reserved until the occurrence of this spontaneous combustion from internal causes is placed beyond any reasonable doubt. (For a minute description of the phenomena which are supposed to accompany this condition, see Casper's 'Wochenschrift,' 1841, Nos. 8, 9, 10; also Henke's 'Zeitschrift der S. A.' 1842, 2, 228; 1843, 2, 39. See also 'Ann. d'Hyg.' 1851, 1, 99; 2, 383.) It is a curious indication of the utter absence of any philosophical spirit of enquiry, that this hypothesis of the spontaneous combustion of the human body should have ever found acceptance among educated persons. It need hardly be observed that there is nothing in the structure of the human body which is not equally found in the bodies of all warm-blooded animals. No one has even ventured to record a case of the death by spontaneous combustion of any domestic animal, for all experience would be adverse to such a statement; and the cases recorded as having occurred in human beings are either untrue, or are explicable as ordinary natural phenomena—the combustion of clothing or furniture, or the result of accident.

Some writers, who have rejected the doctrine of spontaneous combustion, have taken up the view that the human body may in certain cases acquire preternaturally combustible properties. Although they admit that fire is always applied from without, they at the same time contend that from the amount of animal matter found burnt, compared with the clothing or furniture which may have become ignited, the flesh, soft organs, and even bones must have been more combustible than usual. Such a theory as this, however, is not required to explain the facts. Dry animal solids readily burn, but the soft parts either in the living or recently dead body contain as much as 72 per cent. of water, which renders them highly incombustible. Until this large proportion of water is evaporated the substance does not undergo combustion. In many experiments made on different organs and on different bodies, I have not observed that different parts of the same body or the parts of different bodies have varied in their degree of combustibility. The bones alone have withstood a greater degree of heat, from the large proportion of earthy matter contained in them. The experiments have led to this result—the flesh and the organs generally are very difficult of combustion, and can be completely consumed only in a strong fire and under a powerful current of air. Experiments on the bodies of animals have shown that they possess the same property of difficult combustibility. The presence of fat or even of spirit in flesh does not render it more combustible. The fat or the spirit will burn, but the flesh can only be burned by removing from it the substance which interferes with its combustibility—namely, water. There is not the slightest evidence to show that the parts of the body ever acquire increased combustible properties from disease. The theory, therefore, proposed to be substituted for spontaneous combustion, is wholly unsupported by evidence.

Liebig correctly observes: 'With respect to the fuel assumed to have been present in insufficient quantity, this is a very insecure supposition; for fire, the cause of death by burning, has this peculiarity—that it consumes the fuel or matter which supports it, so that the fuel does not remain unaltered, like the knife with which a man has been murdered. (Op. cit. p. 291.) It is, therefore, obviously impossible after a case of burning for any person to define how much fuel has been present before the burning commenced. That which remains is only a part of the fuel which has acted, and it is precisely that part which has disappeared or has been consumed that produces the effect.' (Liebig). This reasoning might be carried a little further. Has the person who gives this opinion of the comparative effects of burning fuel on the human body, ever had any experience of the nature and amount of fuel required to consume a given weight of flesh? It will be found on examination that the statement is a loose conjecture, without a single fact or experiment to support it.

In some cases of accidental burning in which *all* the facts were known, the body is stated to have been much destroyed, compared with the injury done to surrounding objects. In December 1864 a woman given to habits of intoxication was found dead in her room. Her clothes were on fire, and a chair had been burnt. The room when entered was filled with a thick black offensive smoke. On examination it was found that some of the bones were completely deprived of flesh. In the absence of a fire or a candle (which was still burning on the table) this might have been set down as a case of spontaneous combustion, or, by reason of the flesh being burnt from the bones, at least as a case of preternatural combustibility: whereas it was nothing more than a common casualty by fire.

It frequently happens that the skin is much injured by fire, while the muscles and soft parts beneath have suffered but little. There are some circumstances which may occasionally explain the different degrees in which parts of a body are found burnt. An assassin may have employed naphtha or some inflammable spirit, of which no trace can be found; and the great destruction of the body may therefore be due to this extraneous cause, and not to any increased combustibility in its parts. A short exposure to a large volume of flame, owing to its high temperature, will speedily char the flesh and consume it. Articles of female dress, from the quantity of air enclosed between the layers, are capable of producing a considerable volume of flame, which is heat at its maximum degree, and thus the bodies of females are sometimes extensively destroyed (p. 590). Even allowing that the human body might, in certain cases, acquire increased combustible properties, the medical jurist will perceive that this admission does not involve any difficulty in the judicial determination of a question of murder by burning; since it is contended that the combustion of the body cannot possibly take place except by contact with some substance already in a state of combustion. But whether the ignition of the clothes of a deceased person took place accidentally, or by the criminal act of another, is a totally different question: it is one in which a medical jurist is not concerned,—it can be cleared up only by general and circumstantial evidence. Assuming that the body of one person will burn more rapidly and completely than that of another, this will be no answer to a charge of causing death by fire. If urged in defence, that the prisoner might not have intended to destroy the deceased, and that although he ignited the clothes he did it without any malicious intention, and that death would not have been caused by his act but for the preternatural combustibility of the body of the deceased—the obvious answer is that the intention which a person may have had in setting fire to the clothes of another, when he could not possibly know to what degree the burning would extend, is a question for a jury to be decided from the circumstances. The relation of this subject of the alleged spontaneous combustion of the body to medical jurisprudence appears therefore to have been much exaggerated.

Such a defence as spontaneous combustion might afford, would if admitted prove most convenient to those assassins who had endeavoured to conceal their acts of murder by burning the bodies of their victims. Fortunately for the ends of justice, all the facts connected with a murder are now so rigorously investigated, and generally admit of so reasonable an explanation, that such an appeal to the ignorance of a jury would avail but little. In the case of Mrs. *Pulley*, whose body was examined by the late Mr. Jackson of Stamford, in 1860, the circumstances were such as to require but little ingenuity to transform them into a case of spontaneous combustion, although a proper enquiry showed that it was a deliberate murder by strangulation. There was a subsequent burning of the body by means of the clothes, in order to efface the marks of a violent death. The body of the deceased was found lying on the hearth of her room, about three or four feet from the grate. From the shoulders downwards, the body was lying on a boarded floor of oak. The deceased was fully dressed, and parts of her clothing and body had been destroyed by fire. A brass candlestick was lying between the left arm and the body, the top of the candlestick being inclined towards it. The clothes were wholly burnt off both arms, and partly off the upper portion of the body. The legs were not at all burnt. A bonnet which the deceased wore was partly burnt. The right arm was elevated by the side of the body with the elbow resting on the floor. The fingers were partly burnt off, and the remainder of the hand was charred. The left hand, which lay out from the body, was not so much burnt as the right. Some ashes from the clothing lay between the left arm and the body, which was not elevated above the floor. The fire was extinguished, but there was a strong smell of burning in the room. There had been no fire in the grate. Under the body there was a hole in the oak-floor, which had been produced by burning. The features were distorted and swollen, and the eyes suffused with blood. Some parts of the body were burnt to a cinder—others were but little affected by the fire. In order to convert this case into one of spontaneous combustion, it would be simply requisite to ignore the candlestick, and to contend that, as some parts of the body were burnt to a cinder while others were but little affected, the burnt portions of clothes would not furnish a sufficient quantity of fuel to explain the facts! This case is in some respects similar to that of *Millet* (p. 594), but the defence of the man who committed this act of murder did not rest upon spontaneous combustion.

The advice of Baron Liebig in reference to the duties of medical men in cases of alleged death from burning, is deserving of the notice of medical witnesses:—'In cases of fire, when the investigation is extended to all those who had access to the place where it broke out, it often happens that the incendiary or the actual originator of the fire is discovered. Legal medicine, even if the theory of spontaneous combustion were true, which it is not, ought not to interfere in so simple a proceeding, justified as it is by experience, until all other probable causes of fire have been excluded. If such interference take place, those who adopt this course deprive science of its proper rights, and become partakers of the incendiary's guilt; they protect the criminal by misleading those whose duty it is to conduct the investigation. The physician who is called in to give evidence in such cases can only say, if he act according to duty and conscience, in what state the body was found—whether the injuries from burning took place before or after death—whether death was caused by fire alone, or before the action of the fire, by other means,—such as wounds, strangulation, or a blow on the head, &c. In no case is it permitted to him to explain anything he has not seen, by means which he has also not seen, or by a theory which he cannot understand.' (Op. cit. p. 311.)

Cases of alleged spontaneous combustion dependent on accident or homicide.—The following medico-legal case occurred in France. On the 6th of January 1847, the body of a man was found lying in bed, and in a state of combustion, by some persons who entered his bedroom in the morning. The chamber was filled with a dense smoke, and one of the witnesses asserted that he saw, playing around the body of the deceased, a small whitish flame, which receded from him as he approached. The clothes of the deceased and the coverings of the bed were almost entirely consumed; but the wood was only partially burnt. There were no ashes, and but a small quantity of vegetable charcoal: there was, however, a kind of mixed residue, altered by fire, and some pieces of animal charcoal, which had evidently been derived from the joints. The deceased was in the habit of carrying lucifer-matches in his waistcoat-pocket, and, according to his usual practice, he had had a hot brick placed at his feet when he went to bed the preceding evening. Two hours afterwards his son and daughter-in-law passed by the door of his room, but there was nothing which attracted their attention. It was only the following morning, early, that his grandson found his body in the state described. The deceased was 71 years of age. He was not fat, nor was he addicted to drunkenness. The temperature of the air was low; there were no indications of electricity. The son and his wife were suspected of having murdered the deceased, and afterwards burnt the body in order to conceal the traces of the crime; and Dr. Masson was commissioned to investigate the case. The body, which had been buried, was exhumed and examined. The cravat, partially burnt, was still around the neck, and part of a sleeve of a nightshirt was found. The hands, completely burnt, were also attached to the forearms by some carbonized tendons, which gave way on the slightest touch. The thighs were detached, so as to resemble a wilful mutilation, but for the discovery of animal charcoal about them. From these facts, Dr. Masson considered it impossible to ascribe the changes to the effect of accidental burning; and as they could only be produced by violent combustion continuing for some time, he drew the inference that the burning must have resulted from some inherent cause in the person, probably roused into activity by the hot brick placed at the feet of the deceased! The burning once commenced, would be easily supported by the state of the tissues! Hence the case was, in his opinion, to be referred to the class of spontaneous combustions. Orfila is reported to have coincided with Dr. Masson in this opinion, and the accused were acquitted. ('Gazette Médicale,' Sept. 4, 1847.) It is quite possible that the accused had not caused the death of the deceased, for, so far as the description goes, the man might have been accidentally burnt after he had retired to rest. With respect to the medical opinion, that a long-continued action of a strong heat was necessary in order to produce the effects observed, it may be remarked that it is not possible to assign the degree or the duration of the heat which is required to produce particular effects on the body. It appears far more probable that Dr. Masson had underrated the effects which are liable to follow from an accidental ignition of the clothes, than that a warm brick placed at the feet should excite spontaneous combustion in the body, and convert the joints into animal charcoal!

It is singular that, so recently as the year 1850, some German physicians should have been found to advocate the hypothesis of spontaneous combustion in a case of murder. A trial took place at Darmstadt in March and April 1850, in which a man named *John Stauff* was charged with the murder of his mistress, the Countess of *Goerlitz*. This lady was found dead in her apartment: the dress on the upper part of the body was almost wholly consumed: the head exhibited the form of a nearly shapeless black mass, in which the mouth was imperfectly distinguishable, with the charred tongue protruding from it. The skin of the neck, as well as the skin and muscles of the face and upper part of the chest, were much blackened and charred. The joints of both arms were charred on their surfaces, and the blackened ends of the bones protruded. There were no marks of fire on the clothes anywhere beyond the margins of the burns on the body. A writing-desk near the body had been partially burnt, and the floor beneath and in front of the desk, over a space of a foot and a half, had been entirely consumed. The feet of a chair placed near the writing-desk were slightly charred. A folding-board and the drawers were also much burnt. With this clear evidence of the partial destruction of a human body by fire, the physician who was consulted could suggest no other explanation of the facts, than that the body of the Countess must have taken fire *spontaneously*, while she was engaged in writing at her desk! He could not even admit that her cap or dress might have become, by some not uncommon accident among females, ignited by a candle; because, had this been the case, she would, in his opinion, have had time to escape or call for assistance! The other reasons assigned for the adoption of this hypothesis were, that deceased went to bed in good health, that there was a greasy black or sooty substance found about the room, and that the body exhaled an empyreumatic odour. It may be observed that when the room was first broken into, and the Countess was found dead, flames burst out simultaneously from the hangings, the writing-desk, and the floor beneath it, which required to be extinguished by the ordinary process,—namely, by water. The scientific opinion thus given amounted to this—the Countess's body had undergone slow combustion until it reached a full red-heat; it then ignited the furniture around—the reverse of the process by which, according to experience, persons are casually burnt to death. The Countess was thus found dead in her chamber on the 13th of June 1847. On the 26th of November of that year, it was intimated to the Count that an inquest would be held; and the valet Stauff, having in the mean time made an attempt to poison his master, was then first suspected of having murdered the Countess—the death by burning having up to this time been treated as an accidental occurrence. The body, which had been buried, was not exhumed until the 11th of August 1848, *i. e.* fourteen months after death: it was subjected to a special examination, and the Hessian Medical College, to whom the case was referred, came to the conclusion that the Countess had not died from spontaneous combustion. The case was subsequently referred to Prof. Liebig and Bischoff, of Giessen; and their report was issued in March 1850, at which date the man Stauff was put on his trial. They found no difficulty in concluding that a murder had been perpetrated, and the body wilfully burnt *after death* for the purpose of concealing the crime. There was some doubt whether the deceased had died from strangulation, or from violence to the head. Stauff was convicted chiefly upon circumstantial evidence. He subsequently confessed that the Countess had entered her room as he was in the act of committing a robbery. A struggle took place: he seized her by the throat, strangled her, and afterwards placed the body in a chair, piling around it combustible articles of furniture. He set fire to these with the view of destroying the proofs of his crime. It will be observed that the tongue was found protruded, as it is in violent strangulation, and that in its charred state it retained the position given to it by the act of murder.

One of the supposed scientific difficulties in this case was, that the body *appeared* to have been so much consumed compared with the amount of combustibles near it. This, however, seems to have been a mere conjecture

Another point which excited notice was, that the clothes were not consumed beyond the margins of the burns on the body,—a circumstance which has been hitherto regarded as a special characteristic of spontaneous combustion, although it simply shows that when the clothing burns without producing much flame, the burns on the body are defined by the clothing actually consumed. The dark greasy matter on the furniture and the empyreumatic smell are also conditions which by this case are proved to be the results of homicidal attempts to conceal a foul murder, and they are not, in any sense, indications of spontaneous combustion. They are always produced when there is a low or smothered combustion of animal matter. (See, for a further report of this case by Dr. Ogston, 'Medical Gazette,' vol. 46, pp. 889 and 948.)

Time required for the burning of a dead body.—It may be a medico-legal question whether, on discovering a body much burnt, it could be determined from its appearance how long a period it would require to produce the amount of destruction observed. An answer to such a question may be necessary, in order to connect a person with the perpetration of an alleged crime, but the question does not admit of a precise answer. A conjecture only can be formed from the facts proved in each particular case. The human body contains a large proportion of water (72 per cent.); this gives to the soft structures a power of resisting combustion. At the same time there is a quantity of fat in the body, varying in different parts, but amounting to an average of about five per cent. The fat or oil tends to increase its combustibility, and this is still further increased if it is placed on any combustible article which can imbibe it, such as a rug or a deal-floor. The nature of the dress will also make a difference. Under a strong and active flame, which might subsequently burn out before the discovery of the body, there would be a degree of destruction in half-an-hour which a more slow and smothered combustion would not effect in several hours. In the case of the Countess of Goerlitz, it was proved that she had retired to her room between three and four o'clock in the afternoon: the Count returned at seven o'clock, and knocked at the door of her anteroom, but receiving no answer he again went out. Had the burning of the body then commenced, he would have perceived it by the smell, or by the appearance of smoke. He returned again at nine o'clock; and during this second absence, covering an interval of *two hours*, a bright light had been seen at one of the windows, and a thick smoke issued from one of the chimneys. There is a little discrepancy as to the time, but, taking the maximum, the amount of destruction described in this case must have occupied less than two hours, and probably not more than one hour.

This question actually arose in *Reg.* v. *Hatto* (Aylesbury Lent Assizes, 1854), in which I was consulted. The deceased, a female, was found dead in her room, and her body much burnt. She was last known to be living at about a quarter-past eight o'clock in the evening, and her body was found, still smouldering with fire, on the floor of the room at about a quarter-past eleven o'clock. The only persons known to have been in the house were the prisoner and deceased. The prisoner pretended that he knew nothing of the circumstances attending her death, and endeavoured to make it appear that robbers might have broken into the house and committed the murder, at some period of the three hours during which he alleged that he was asleep in bed. For the prosecution, it was suggested, in order to exclude this hypothesis—which, however, was sufficiently excluded by other facts—that the act of murder, with the attendant burning, must have occupied the whole of the time intervening between the period at which deceased was last seen living, and the period at which her body was found. The medical gentleman who examined the deceased found that 'both knees were consumed by fire, and the thighs, as well as the private parts, were burnt to a cinder—leaving the shafts of the thigh-bones exposed and charred for several inches. Between the thighs and the feet, the floor underneath had been burnt away, and the leg-bones had fallen through the floor, leaving the feet unburnt on the floor.' He expressed an opinion that it would take from two-and-a-half to three hours in order to consume the body to this degree; thus covering the whole interval during which deceased and prisoner were in the house together. It should be stated that the clothes of the deceased were much burnt, and that beneath the body there was a hempen mat, so combustible, owing to the melted human fat with which it was impregnated, that when ignited I found that it burnt like a link. The guilt of the prisoner did not depend on an answer to this question; that was made sufficiently clear from other circumstances proved in the case, which were quite inconsistent with his innocence. It is obvious that an opinion on such a subject must be in all cases conjectural, since the effects, *cæteris paribus*, depend as much on the intensity as on the duration of the heat. It was indeed just as probable, medically speaking, that, with a large body of flame, the amount of injury met with might have been produced in an hour as in three hours; and if the question were proposed to any number of medical men, in entire ignorance of the bearing which their answers would have on the case, there would be probably no two answers alike. The confession of the prisoner, subsequently made, shows that the burning observed must have taken place in less than two hours, and probably within an hour and a half. The *Goerlitz* case and some others prove that a short period may suffice for a large amount of destruction, and that, judging by what remains, the combustible materials consumed appear to bear only a small proportion to the parts of the body burnt. This may be accounted for by the large volume of flame produced during the combustion of female articles of clothing; and flame is matter ignited to the highest temperature.

SPONTANEOUS COMBUSTION OF MINERAL AND ORGANIC SUBSTANCES.

Although there is an entire failure of evidence to show that the animal body is liable to spontaneous combustion, there is good reason to believe that this phenomenon may occasionally manifest itself in certain organic and mineral substances, and cause destruction of life and property. Under these circumstances, a person may be unjustly charged with an act of incendiarism, and the proof of his innocence may depend upon the skill and knowledge of a scientific expert who is required to investigate the case. Evidence on this subject may be demanded in cases of marine insurance, in which it is alleged that ships and their cargoes have been destroyed by spontaneous combustion; or where articles of merchandise have been accumulated in a populous neighbourhood, and life and property are said to be endangered by their liability to accidents of this nature.

Towards the latter part of the last century several fires occurred in the Russian navy, as well as in the warehouses on shore. These were attributed, in the first instance, to acts of incendiarism; but it was subsequently discovered that they were owing to the spontaneous heating and ignition of large quantities of hemp and flax impregnated with oil. Experiments were made on the subject by the Imperial Academy of Sciences; and it was shown to the satisfaction of the Russian Admiralty that such materials, when heaped together in buildings and allowed to remain for some time, would, under a sufficient access of air, ignite spontaneously. (Paris and Fonblanque 'Med. Jour.,' vol. 1, p. 410; also, 'Annales d'Hygiène,' 1841, vol. 1, p. 364.) The great fire in Plymouth Dockyard, in 1840, was supposed to have arisen from a similar cause, although there was also a strong suspicion that this was the act of an incendiary. On a recent occasion an injunction was sought for against certain merchants for the storage and drying of jute on premises in the vicinity of which there was much valuable property. It was alleged, among other grounds, that jute in the wet state was liable to undergo spontaneous combustion. The subject is therefore of practical interest, and requires consideration from a scientific witness.

Mineral substances.—The facts connected with the spontaneous ignition of mineral substances are generally known to, and seldom admit of doubt among, scientific men. The mere exposure of a variety of substances to the air, at any temperature, is sufficient to cause their combustion almost instantaneously. Phosphorus dissolved in sulphide of carbon furnishes an instance of this kind. If the solution is poured upon paper, so soon as the solvent has evaporated the particles of phosphorus are left on the paper in a minutely-divided state. By their sudden combination with oxygen, sufficient heat is produced to cause inflammation of the phosphorus. It burns, but the flame does not readily kindle paper or other combustible substances. Tartrate of lead and Prussian-blue heated in a tube yield respectively lead and iron in a very finely-divided state. When the tubes are broken, and the powders are brought into contact with air, the metals are instantaneously oxidized, and burn with a bright light. These substances are well known as pyrophori. Spontaneous combustion is in these cases owing to the state of extreme division of the particles of matter, and to the heat produced by instantaneous oxidation over an extensive surface. This heat is sufficient to render the small metallic particles incandescent. Some substances in the state of vapour or gas, as phosphide and silicide of hydrogen, burn at once with a volume of flame on exposure to air. The combustible substance is here placed in a state most favourable for sudden ignition at the common temperature of the atmosphere.

Ordinary *Charcoal* does not undergo combustion in air until it has been heated to a temperature of from 1000° to 1200°; but it would appear that in some states it is liable spontaneously to acquire a temperature which may lead to its unexpected combustion. Liebig asserts that there is no example of carbon alone, even in the finest state of division, combining directly with oxygen at common temperatures, but that numerous facts show that hydrogen in certain states of condensation possesses this property. Lampblack, which has been heated to redness, may be kept in contact with oxygen gas without forming carbonic acid; but lampblack impregnated with oils which contain a large proportion of hydrogen gradually becomes warm, and inflames spontaneously. He also assigns the spontaneous inflammability of the charcoal used in the manufacture of gunpowder to the hydrogen, which it contains in considerable quantity; for during its reduction to powder no trace of carbonic acid can be detected in the air surrounding it. It is not formed until the temperature of the mass has reached a red-heat, *i.e.* 980° to 1160°. ('Organic Chemistry applied to Agriculture and to Physiology,' p. 263.) The heat which produces combustion therefore, in Liebig's opinion, is not caused by the oxidation of the carbon.

Some years since a ship, laden with casks of *Lampblack*, sailed from Portsmouth. In about six weeks afterwards a strong smell of burning was perceived to issue from the forehold, accompanied with smoke. On examination, it was found that a large cask of lampblack was giving out volumes of smoke, although not actually in flames. It was with some difficulty, owing to the intense heat of the cask, that it could be got on deck and thrown overboard. It was presumed that the admission of air to the interior of the cask would have caused its instant ignition. In consequence of this discovery, the whole of the lampblack on board, to the number of sixty-one casks, was thrown into the sea, and several of them were observed to be in a state of smothered combustion. The casks were surrounded by a number of barrels of tar and jars of oil, and it is probable that owing to leakage, oil had become mixed with the contents. No light had been allowed in the hold since leaving England, hence there was no source of external ignition. It was highly probable from all the circumstances, that it was a case of spontaneous combustion such as Liebig has described. ('Ann. d'Hyg.,' 1841, vol. 1, p. 343.)

According to M. Aubert, a French engineer ('Annales de Chimie,' 1831), recently-made charcoal in a fine state of division is liable to become spontaneously ignited without reference to admixture with oil. He states, as the result of his observations, that when recently-made charcoal was reduced to a very fine state of division, it rapidly absorbed air and aqueous vapour, especially the former. The air underwent no change up to the moment at which combustion ensued; but a considerable quantity of heat was extricated, which this experimentalist found at one time to be equal to 350° F. The greatest degree of heat was observed to be in the centre, or about five or six inches below the surface; and it appears that ignition first commenced here, if there were a tolerably free access of air. M. Aubert found that the most inflammable charcoal required to be in masses of at least sixty pounds in order that combustion should take place spontaneously, and the less combustible the charcoal, the larger the quantity required to be collected in a heap. In all these cases the charcoal was pulverized, and the shorter the time suffered to elapse between its manufacture and its pulverization, the more certainly and rapidly did combustion take place. I have found by experiment that freshly-made charcoal introduced into a mixture of oxygen and sulphuretted hydrogen in explosive proportions, suddenly became intensely heated and caused the gases to combine with explosion. It has been long known that charcoal rapidly absorbs and condenses gases and vapours up to a certain point, but oxygen as it exists in the air is much less absorbed than others. It has also been observed that, whether there is chemical union or not, this absorption is accompanied by a slight elevation of temperature. That it should be sufficient to reach 1000°, and thus ignite the mass, is not probable —at any rate, no danger has been apprehended by English chemists from the accumulation of large quantities of charcoal on one spot. M. Chevallier, however, in a paper on Spontaneous Combustion, has referred to several instances of the ignition of charcoal by spontaneous heating. ('Ann. d'Hyg.,' 1841, vol. 1, p. 339.) M. Robin describes a case in which finely-powdered charcoal recently prepared became ignited. (Op. cit., p. 342.)

Coals containing pyrites.—There have been many instances of the ignition of coals as a result of the presence in them of certain kinds of iron-pyrites, and actions for damages to merchandise have been brought. When water comes in contact with a large heap of coals containing pyrites, a chemical action takes place whereby the mass is heated; and if favourably placed for the retention of heat, as in the hold of a ship, the effect may be the heating of the coals to the point of combustion, and the destruction of the vessel and cargo. Mr. D. Campbell informs me that, in 1859, he was consulted in reference to the following case. A ship took in a cargo of 640 tons of coals at Hartlepool, for the port of Aden. In the course of her voyage along the English coast she shipped a great quantity of sea-water, which completely wetted the coals. From an apprehension of spontaneous combustion and damage by sea-water the coals were landed at Lowestoft. A question arose, whether the captain was justified in landing the coals because they had been wetted by sea-water: he considered there was great risk that they would spontaneously ignite before the termination of the voyage. Mr. Campbell examined the coals after they had been landed; they were then piled to a height of from six to nine feet, and were of a much higher temperature in the interior than on the exterior. They contained iron-pyrites, and had begun to undergo disintegration from the chemical action of the sea-water. As there was no combustion after landing, it was inferred that the coals might have been safely conveyed to their destination. Further, it was suggested that had the sea-water been washed out of them by ordinary water, or had they been transferred at once to another ship, spontaneous combustion would not have been liable to occur. That there was no combustion after landing was very properly explained by the fact of the coals being so spread out as to allow of a cooling effect by the air; secondly, whether wetted with salt-water or fresh was of little moment,—if combustion took place at all, it would as readily occur with one kind of water as the other; and thirdly, if transferred to another ship in a wet state, combustion would have taken place more readily when the coals were accumulated in the dry hold of a vessel, where the air could have no cooling power.

The experiments of Frankland ('Chemical News,' 1862, vol. 6, p. 3) show that a full red-heat, visible in daylight (1160°), is required for the ignition of the gases derived from coal. In the decomposition of water, a very offensive inflammable gas is evolved—namely, sulphuretted hydrogen. This would give warning of the chemical changes which were going on, and long before an igniting temperature was reached, much aqueous vapour, mixed with a thick yellow smoke having an offensive tarry odour, would be perceptible. The coals of some localities are especially liable to these changes, by reason of the large quantity of pyrites (sulphide of iron) associated with them. The Yorkshire coals from Hull, and some varieties of coal from South Wales, have given rise to these accidents. The pyrites which most readily undergo spontaneous combustion are those in which the protosulphide is associated with the bisulphide of iron. (Dumas' 'Traité de Chimie,' vol. 3, p. 59.) Too much water or too great an exposure to air will counteract the heating process. The intense heat produced by the slaking of fresh-burnt *lime* on which water has fallen is sufficient, when in a large mass, to account for the ignition of combustible bodies with which it is placed in contact. The substance is not itself combustible, but by the chemical action of water a degree of heat is produced which may cause the combustion of coal, wood, or other articles.

Sulphur, although highly combustible, has no tendency to spontaneous combustion. It does not absorb oxygen or combine with it below a temperature of 400°, which can only be reached by its receiving heat from some external source. Sulphide of carbon—the vapour of which, is more inflammable than the vapours of alcohol, ether, and wood-spirit,—takes fire at a black-heat, and according to Dr. Frankland, at a temperature as low as 300°. ('Chem. News,' 1862, vol. 6, p. 4.) There is no gas or vapour which is kindled into flame at so low a temperature as this. Coal-gas, the vapours of alcohol, ether, oil of turpentine, and benzole require a full red-heat, visible in daylight (1160°), for burning with flame. Wood-spirit vapour also requires for ignition a red-heat, but it is more easily kindled than those above mentioned, and the flame spreads rapidly. I have not found any of these inflammable vapours to ignite at the melting-point of lead (620°), while the vapour of sulphide of carbon takes fire before it touches the melted metal. In one instance that came to my knowledge, there was reason to believe that the vapour of sulphide of carbon in an India-rubber factory was ignited by solar heat traversing glass, as it was supposed, from a refraction of the sun's rays.

It is necessary here to advert to an error which appears to prevail respecting the vapours of inflammable liquids. It is supposed, because the liquids are highly combustible, that the vapours which they give off at common temperatures or at a low degree of heat are spontaneously inflammable, or are liable to be inflamed at a very low temperature. The above-mentioned liquids give off vapours at different temperatures, which are combustible if a flame or visibly red-hot metal is brought directly in contact with them, but not otherwise. In this respect they do not differ from the most inflammable gases, such as hydrogen and coal-gas, which are not ignited by a temperature below a visible red-heat (1160°); and unless this temperature is reached, the vapours and gases do not take fire. The liquids differ in their volatility. Sulphide of carbon is entirely converted into vapour at 110°—wood-spirit or naphtha at 140° to 150°—alcohol at 174°—coal-naphtha at 176°—and oil of turpentine at 312°: but these liquids evolve a highly inflammable vapour at temperatures below 100°; and this vapour, if accidentally kindled by flame or a red-heat, may spread destruction. Those combustible liquids are safe which evolve no vapour at common temperatures, but burn only with a wick: *e.g.* colza-oil, rectified paraffine oil, and petroleum, when freed from the highly volatile hydrocarbon vapours which are generally associated with it. The Petroleum Act limits the storage of this liquid near dwellings, in reference to any sample which gives off an inflammable vapour (naphtha) at a temperature of less than 100° of Fahrenheit's thermometer. ('Chem. News,' 1862, vol. 6, p. 169.) This has been taken by some to imply, that the vapour is actually inflammable at this low temperature—whereas it merely implies that those liquids are dangerous, when stored in large quantity, which give off, at or below 100°, a vapour that will take fire by contact with flame, or solids heated to full redness. Solids which give off no vapours below their temperature of combustion (such as dry flax, cotton, or jute), although highly combustible, are not dangerous in a like degree. Vapours may be ignited at a distance from the liquids, and fire will instantaneously spread throughout the mass with explosive violence—whereas in dry solids of the nature above described, flame or a red-hot solid must be directly applied to them to cause combustion; and although they burn readily, combustion is not so rapid as with inflammable liquids.

Phosphorus. Lucifer Matches.—Phosphorus, when in a dry state, has a great tendency to ignite spontaneously. As it undergoes oxidation at all temperatures when exposed to air, and its igniting-point is lower than that of any other solid, there is always danger unless this substance is kept in water. I have observed it to melt and take fire (when touched) in an apartment in which the thermometer was under 70°. In experiments on this substance in the dry state, I have found its melting-point to be 113°. It may be heated in air to a temperature of 110°, without melting or inflaming, and it does not inflame until after it has melted. Even when perfectly fluid at 113° it does not take fire until the surface is touched. At 120° it melts and burns readily. The ordinary lucifer-match composition takes fire at about the same point (120°). During the summer this composition is luminous in the dark, a fact which shows that oxidation is going on, and, therefore, a process of heating. Hence large quantities of these matches kept in contact may produce a heat sufficient for ignition. Still it is rare to hear of spontaneous combustion from them, and when they become ignited it is probably the result of some mechanical cause. The slightest friction is in some instances sufficient for this purpose. I have seen them ignite as a result of exposure to the sun's rays for the purpose of drying: they ignited in an attempt to remove them. Red or allotropic phosphorus mixed with chlorate and nitrate of potash forms a paste for wax-matches. In order to ignite this composition, a temperature of 159° is required. Some samples have resisted a heat of 200°, and have only slowly undergone combustion when kept for some time at a temperature of 212°. I have noticed that dry oxide of phosphorus will spontaneously take fire at common temperatures.

Mixtures of solids containing sulphur are not liable to spontaneous combustion, although they will burn from a slight increase of temperature by friction or otherwise. In reference to *Gunpowder,* there is no instance recorded, so far as I am aware, in which this substance has spontaneously ignited. Of its three constituents, nitre has no tendency to undergo any change, and is not itself combustible. Sulphur does not ignite under 400°, and charcoal not below 1000°. The finest gunpowder requires a temperature of 525° for its inflammation and perfect combustion. There is no tendency to spontaneous heating in a mass, the charcoal forming only one-eighth part. If such tendency exist, the nitre which forms three-fourths of the mixture would not readily receive or diffuse the heat. This may account for the fact that the igniting temperature of 525° is never reached except from some external cause of heating, such as friction or attrition; but the smallest particle thus heated may explode any quantity. An invisible or black heat is quite sufficient to inflame this substance.

A singular fact was communicated to me by the late Mr. Scanlan in relation to an inflammable composition which is much used in theatres and pyrotechnics under the name of *Red-fire.* It consists of a mixture of chlorate of potash, charcoal, sulphur, sulphide of antimony and nitrate of strontia. One of his friends had placed a quantity of this powder in a storeroom. On the following day, while this gentleman was in an adjoining apartment, it spontaneously ignited and was entirely consumed. The quantity which thus underwent spontaneous combustion is not stated, but neither before nor since has any instance of a similar kind been observed, although the substance is manufactured and used in large quantities. I find that a black-heat (i.e., below 900°) is sufficient for the kindling of this substance.

Organic Substances. — The most important questions on spontaneous combustion have arisen in reference to organic substances chiefly of vegetable origin. It is unnecessary to refer to those accidents which occur from the admixture of strong nitric or sulphuric acid with straw, wool, or certain essential oils. The effects in such cases, if any, are generally immediate, and create no difficulty. In other cases, without contact with any chemical agents, certain substances—such as hay, cotton, and woody fibre generally, including tow, flax, hemp, jute, rags, leaves, spent tan, cocoa-nut fibre, straw in manure-heaps, &c.— when stacked in large quantities in a damp state, undergo a process of heating from simple oxidation (eremacausis) or fermentation, and after a time some of them may pass into a state of spontaneous combustion. Among these substances, hay and cotton in a damp state have been known to become ignited without any external source of ignition. With regard to the other substances, when stacked in a wet state under similar circumstances, it has been ascertained that they become heated so as to evolve copiously aqueous vapour; but, so far as I am aware, the heat has not reached a charring-point of 600°, or an igniting-point of 1160°. No smoke or smell of incipient combustion has been produced. One case is reported in which wet flax is said to have ignited spontaneously, and to have destroyed a ship and her cargo, but ignition from an external source was by no means excluded. ('Ann. d'Hygiène,' 1841, p. 359.)

It is within the experience of most persons that newly-stacked hay insufficiently dried becomes, after a few days, hot in the centre of the stack, and aqueous vapour or steam escapes: this is followed by smoke and a peculiar odour of partially-burnt vegetable matter, and, on examining the interior of the stack at this time, the hay will be found of a dark-brown colour almost charred. At a still later period a thick smoke will issue, followed by ignition or kindling on exposure to the air. According to the testimony of shippers and merchants, raw cotton stacked in quantity, or packed in the hold of a ship before it is thoroughly dry, undergoes a similar series of changes, and is liable to become ignited by the access of air. It was probably owing to the spontaneous combustion of cotton that the merchant ship the 'Earl of Eldon' was destroyed by fire in 1834. I ascertained from the captain of the ship that the cotton which he had on board had been brought down to Bombay during the wet season,—that no attempt was made to dry it properly before shipping it, and that in this state it was closely packed between-decks, as well as in every spare part of the vessel. About a month after leaving the port, the crew were alarmed by an abundance of vapour issuing from the fore-hatchways. The vapour became more dense, and assumed the character of a thick smoke. Several bales of cotton were removed, but the danger became thereby increased, owing to the free current of air created, and in a very few hours the deck caught fire. The ship was then abandoned, and its total destruction speedily followed. I have since heard of several instances of a similar kind, but in some of them the theory of spontaneous combustion appears to have been too readily adopted. A ship laden with cotton is liable to destruction at all times by the careless use of fire—by candles, lucifer-matches, or the smoking of tobacco. It is scarcely possible, in such cases, to exclude entirely any of these accidental sources of external ignition: and to assign the accident to spontaneous combustion because no cause is apparent is illogical. The materials causing the fire are consumed with the cargo. The person who has been carelessly or unconsciously the cause of the fire makes no statements, and the cause can therefore be only matter of conjecture.

Cotton impregnated with *oil*, when collected in large quantity under circumstances favourable for the retention of heat, appears to be liable to spontaneous combustion. An accident of this kind occurred in New York in 1832, in which a ship and her cargo were entirely destroyed, from no other cause, so far as could be ascertained, than the spontaneous ignition of some bales of cotton on which oil had become accidentally spilled. M. Chevallier refers to other cases ('Ann. d'Hyg.' 1841, vol. 1, p. 367). The accumulation of cotton-waste used in wiping lamps and the oiled surfaces of machinery has been also said to give rise to accidents of a similar kind. M. Chevallier reports the case of a man who was charged with setting fire to a house. The fire had occurred in two corners of the building at the same time—one on the ground-floor, and the other on the second-floor. A large quantity of cotton-waste had been placed on these two spots, and it was supposed these had been wilfully ignited. The person accused was fortunately able to prove an *alibi*, and he was acquitted. The cause of the fire remained inexplicable, until about six months afterwards. M. Chevallier in accidentally passing a factory saw a heap of a similar material burning in one corner of the yard; and on inquiry he found it to be cotton-waste which had spontaneously ignited, and had been removed from the factory to that spot in order to guard against fire. In his judgment and that of his co-experts, who were prepared to give their opinions against the man charged with incendiarism, the cause of the fire was thus satisfactorily explained. ('Ann. d'Hyg.' 1842, vol. 1, p. 211.)

So far as I can ascertain, the admixture of oil, especially siccative or drying oil, with dry woody fibre of any kind, is more likely to give rise to heating and combustion than an admixture with water. The oil, besides more rapidly absorbing oxygen, is itself highly inflammable at a red-heat. Water is not only incombustible, but in a quantity of fifty per cent. renders woody fibre indestructible by fire, so long as it remains in the fibres or pores. A friend informed me that an instance had occurred within his knowledge where a fire took place in a druggist's shop by reason of a quantity of oil having been spilled on dry sawdust. Vegetables boiled in oil furnish, according to M. Chevallier, a residue which is liable to spontaneous ignition ('Ann. d'Hyg.' 1841, vol. 1, p. 370). In the opinion of this writer, all kinds of woollen articles imbued with oil and collected in a heap may inflame spontaneously. (Op. cit. p. 369.) Hemp, tow, or flax, similarly imbued with oil may become heated and the temperature reach a degree to cause them to ignite spontaneously. In the manufacture of floorcloth and sailcloth, mixtures of this kind are generally made, and the storage of these articles in close chambers under circumstances favourable to the retention of heat, may give rise to accidental combustion. For cases of this kind see 'Ann. d'Hyg.,' 1841, vol. 1, p. 373.

From some experiments made in Russia, it appears that a mixture of any drying oil with lampblack, in certain proportions, is liable to spontaneous ignition. The proportions most favourable for this were found to be about equal parts of lampblack and linseed-oil. In 1781 a fire broke out in a Russian frigate while lying in the harbour of Cronstadt. There had been no fire on board the vessel for five days. On tracing the source of the smoke, it was found to issue from the sailroom, and some of the sailcloth was in a state of combustion. A mixture of boiled oil and lampblack had been prepared for painting the vessel. It was believed that the contact of this with the hempen fibres had led to the accident. A similar mixture spread on cloth and laid aside in a hammock became heated, and took fire in about twenty hours on letting the air have access to it. (Op. cit. vol. 1, p. 384.)

Accidents from a similar cause are said to have occurred in France in the preparation of a balsam in which olive-oil was used with dry vegetable matter. In two cases the residue is said to have become hot, and to have given off a vapour having a strong smell of burnt grease. In one instance the mass became simply carbonized; in the other it became incandescent, and would have communicated flame to any combustible which might have been in contact with it. ('Journal de Chimie Médicale,' 1846, p. 672, and 1847, p. 558.) Although no cases are, so far as I know, recorded, it is probable that linen and cotton rags, paper, jute, and cocoa-nut fibre imbued with oil might undergo similar changes.

Questions involving points of commercial law necessarily arise in reference to these substances. In the case of *Koebel* v. *Saunders* (Common Pleas, Westminster, January 1865), an action was brought by plaintiff on a policy of insurance on a cargo of cocoa-nut oil from Cochin to Marseilles. The casks of oil were stowed with cocoa-nuts, which were liable, if not dry, to heat and ferment. They did heat and ferment, and the staves of the casks so shrank therefrom that the hoops came off, and much of the oil escaped by leakage, while other portions were damaged. The plaintiff alleged that the heating of the cargo was occasioned by sea-water getting into the ship from bad weather, and causing the cocoa-nuts to ferment, and that the loss was occasioned by perils of the sea, and therefore that the insurers were liable. The defendant contended that the heating of the cocoa-nuts was natural, and that the fermentation began before there was any bad weather, and then went on, occasioning the loss, and that for the loss so caused they were not liable. A verdict was obtained by the plaintiff. Spontaneous combustion was not the question at issue in this case, although the leakage of oil was favourable for this occurrence.

Woody fibre impregnated with turpentine, according to the observation of the late Mr. Scanlan, is liable to spontaneous ignition. He communicated to me the following case, which he has elsewhere published ('Records of Science,' August 1835). In March 1835, a fire broke out in a turpentine distillery at

Dublin. The fire was confined to what is termed by turpentine-distillers chipcake; and it could only be attributed, under these circumstances, to the act of an incendiary, or to the spontaneous ignition of this substance. The raw American turpentine, as it is imported, contains many impurities in the form of chips of wood, leaves, and leafstalks. These impurities are commonly separated by heating the turpentine to about 180° and straining it: the mass thus separated (which is subsequently exposed to a temperature of 212°) is called chipcake: when thus obtained, it has not been known to undergo spontaneous combustion. On the occasion above mentioned, a new plan had been adopted by the manufacturer. The raw turpentine with its impurities was exposed at once to a temperature of about 250°, and the melted rosin was then strained from the chips. The dry chipcake from this process was laid in a heap outside the still-house about three o'clock in the afternoon, and at midnight it was observed to be in flames. Mr. Scanlan found, in making his observations upon a portion of chipcake thus prepared, that the temperature gradually increased towards the centre of the heap, although on the exterior it was cold and brittle. In four hours a thermometer rose to 400°, and a large quantity of vapour, accompanied by a strong odour of pitch and rosin, was extricated. The exposure of the mass experimented on took place at one o'clock in the afternoon, and although it rained hard during the night, at half-past seven the following morning it burst into a flame. Three other experiments were made with similar results: in the third, the porous heap appeared to become red-hot in the centre, so that the adhering resin melted and dropped from beneath.

The effect of *water* in promoting the heating and spontaneous combustion of vegetable substances appears to be far inferior to that of oil. With the exception of hay and cotton, I have met with no instance of the spontaneous ignition of woody fibre as a result of its being simply wetted and exposed to air. The straw in manure-heaps, spent tan, jute, flax, hemp, cocoa-nut fibre, rags, and waste paper wetted, are subject to a process of spontaneous heating, giving rise to the escape of aqueous vapour or steam; but I have not found any authentic instance in which this heat was proved to have reached the temperature necessary for combustion. Analogy tells both ways: for while cotton has thus ignited, spent tan which is in an equally favourable state for combustion, although collected in enormous heaps, has never been known to ignite spontaneously. In the manufacture of white lead, spent tan is frequently piled up in large quantities under sheds. The mass becomes heated, and evolves aqueous vapour and carbonic acid. This heating, so far as I know, has never gone on to such a degree as to cause ignition. A friend who, in the course of business, has largely employed the finer portions of cocoa-nut fibre and dust, informs me that when it was piled in large heaps in a damp state, he had observed that the temperature rose, and steam escaped from it; but he had never known it to reach the temperature of boiling water, and he had never heard of its igniting spontaneously.

The same may be said of flax and jute. In cases in which it is alleged that these substances have kindled spontaneously, careful inquiry has shown, or rendered it probable, that there was an external source of ignition, either from drying the substance by artificial heat or from a careless use of fire.

One circumstance appears to have been overlooked in reference to this subject. Assuming that there is not too much water in the fibre, the heat is not likely to reach the burning-point at or above 1000°, unless an enormous quantity of the material is accumulated in a stack or heap, or enclosed under cover as in the hold of a ship, where there is no circulation of air. The material which thus piled up or stored would retain the heat and ignite, is rapidly cooled when spread out so as to expose a large surface to air, especially if it is frequently turned over. Hay is never known to ignite until it has been placed in a stack: if kept in the field in small heaps, and turned, it never becomes so heated as to pass into combustion. Thus the mode of storage is as important a condition as the presence of water. It is a fair inference from these facts, that no substance liable to spontaneous heating acquires a temperature sufficient to create a risk of fire when it is opened out and freely exposed to air. To compare this condition of the material with the close package of cotton in the hold of a vessel, or of hay in a stack where there can be no ventilation, must necessarily lead to a wrong conclusion.

In the following case (*Hepburn* v. *Lordan*), which came before Vice-Chancellor Wood in January 1865, there was a material called *jute*, a vegetable fibre derived from the *Corchyrus capsularis*, resembling flax;—there was water, and air, but the condition of stacking or storage in a confined space was wanting. The defendants had collected in an open yard in Bermondsey a quantity of jute, amounting to about three hundred tons. The jute in question was the salvage of a fire which had occurred on the 26th November 1864. Part of it was damaged by fire, and the whole of it was so thoroughly saturated with water as to render it unfit for commercial purposes. It was admitted on all sides that jute in a dry state, although very combustible when ignited, would not undergo spontaneous combustion: but it was contended for the plaintiff, who occupied a large leather factory adjoining, and who was heavily insured, that the damp jute was in a heated state, and there was imminent danger of its taking fire spontaneously. No evidence was adduced to show that jute in this state had ever been known to undergo spontaneous ignition, but reliance was placed on the analogous condition of cotton. On the part of the defendants, there was evidence from merchants and shippers that, although they had for about fifteen years imported the article from the East Indies largely, and had seen it brought down the Ganges in open boats in a wet state, they had never known it to undergo spontaneous combustion: it became heated, and then dried. The defendants' jute had been examined on the 4th January, sixteen days after it had been placed in the yard, and nearly six weeks after it had been wetted by water: one portion of the heap then felt hot to the hand, and in another part, at about a foot deep, the thermometer rose to 103°. Aqueous vapour issued from it in quantity in many parts. On these facts it was reported as dangerous, and liable to sudden and spontaneous ignition. I was requested, on the part of the defendants, to examine and report on the state of the jute. This examination was made on the 17th January, *i.e.* a fortnight later, with the following results. The jute was in scattered heaps of from four to seven feet in height, covering a very large area and exposing an extensive surface to the air: the quantity was then stated to be from 250 to 300 tons. Aqueous vapour issued from it in several parts, and other portions evolved vapour when turned over. A number of observations were made with thermometers, in various parts of the jute and at different depths. The temperature of the air was then about 45°. In six observations at from 18 to 24 inches below the surface, the temperature varied from 67° to 85°. The thickest portion of the heap, at a foot and a half below the surface, had a temperature of 125°; at two feet, of 133°; at three feet, of 140°; at four feet, of 130°; at five feet, of 128°; and at six feet, *i.e.* within one foot of the ground, of 117°. The temperature thus increased as the centre was approached, and decreased equally upwards and downwards. Thin slips of fusible metal, melting below 212°, were employed as a test, but this compound was not melted in two of the hottest parts examined. It was therefore clear that no part of the jute had reached within 70° the temperature of boiling water, although it had been nearly a month on these premises, and seven weeks had elapsed since it was first damaged by water. The aqueous vapour which escaped from the hottest portion (at 140°) was unmixed with smoke or any of the products usually evolved from bodies in a state of torrefaction or incipient combustion. The vapour was simply that of water derived from the jute, which was still sodden, and there was a faint trace of carbonic acid in 100 cubic inches. The jute presented no appearance of charring in any part, except where it had suffered from the fire in November.

A portion of the jute from this the hottest part was found on analysis to contain 50 per cent. of water. It could not be made to burn in a strong gas-flame; and a red-hot bar of iron passed over it, merely charred it at the spot touched without inflaming it. The jute, which was being carted away as dry, was found to contain 16 per cent. of water. This could be ignited in a gas-flame, and readily burned when touched with a bar of iron at a red-heat. On these facts, and considering—1st, that this jute had been exposed to air over a very large area, for at least a month, without acquiring the heat of boiling water, while its ignition when dry does not take place below a temperature of 1000°; 2ndly, that it then contained half its weight of water, which rendered it incombustible when flame and a red-heat were directly applied to it; 3rdly, that there was no odour of torrefaction or charring, and that no products of the ordinary combustion of woody fibre were present in the vapour which escaped from the centre of the heap; 4thly, that the maximum thickness of the heap was not more than seven feet; 5thly, that the whole of it was turned over twice a week to ensure more rapid drying; and 6thly, that as it dried and became combustible it was removed from the premises daily—I came to the conclusion that there was no danger of spontaneous combustion under the conditions in which this jute was placed. The Vice-Chancellor granted an injunction on the ground not of spontaneous combustion, but of the danger of external ignition.

On the 6th of February, *i. e.* three weeks later, the jute was again examined for temperature. Instead of becoming hotter it had become cooler: the highest temperature, out of thirteen observations in different parts, was 120°. This was at eighteen inches from the surface: at a depth of three feet the jute had a temperature of 105°; the other temperatures ranged from 55° to 90°. The question, therefore, appeared to have been simply decided by lapse of time: in ten weeks there had been no heat generated which approached to ignition. The experiments above mentioned do not prove that damp jute will not in any case spontaneously ignite, but they show that, under the circumstances in which this jute was placed, there was no risk of ignition as a result of chemical changes. It is impossible to prove a negative: but if from the emission of aqueous vapour, and the production after ten weeks' exposure of a temperature not exceeding 140°, it is inferred that damp jute will become suddenly dry and spontaneously ignite, then such substances as spent tan, cocoa-nut fibre, rags, and manure in a damp state (which in large massess become heated and emit aqueous vapour) must equally be regarded as liable to spontaneous combustion.

In February 1865 this case was carried by appeal before the Lords Justices, who dissolved the injunction. It was admitted by all, that dry jute was a highly combustible and therefore a dangerous substance when collected in large quantity in a populous neighbourhood. This remark, although true in the abstract in reference to dry jute, was wholly inapplicable to that which was spread over the defendants' premises, as this was so damp that it would not ignite by the application of flame or a red-heat. Whatever objection may apply to the storage of dry jute as a combustible substance, there can be none to the storage of wet jute containing half its weight of water.

Many fires, including the great fire at London Bridge in 1861, have been referred to the spontaneous combustion of jute in its ordinary state; but that this substance should bear a long sea-passage from the East Indies without manifesting any signs of combustion, and should only take fire from this alleged cause many weeks or months after it had been deposited in an English warehouse, is wholly incredible. In all the fires yet known where this substance has been burnt, ignition from external causes, if not proved, was highly probable. At any rate, should the external cause not be at once discovered, or should it be considered inadequate, this is no reason for assuming that the substance has spontaneously taken fire, either in the wet or dry state. Such loose reasoning as this would equally show that the human body was spontaneously combustible.

Considering that this subject involves life and property to an enormous extent, it is to be regretted that there is a want of accordance in scientific opinions. These cases hardly admit of experiments on a sufficient scale at the hands of scientific men. The material requires to be employed in enormous quantities, and to be stacked or disposed under circumstances not open to experimentalists—hence in framing their opinions they can only be guided by the facts hitherto known and recorded. Those facts, so far as they are at present known, are adverse to the theory that wet woody fibre, if we except cotton, can become so heated as to ignite spontaneously. Even with regard to cotton more accurate observations are required. The great fires in the Liverpool dock-warehouses some years since were ascribed to the spontaneous combustion of cotton; but external ignition from gas, the smoking of tobacco, or the use of lucifer-matches was highly probable, and never completely excluded by the evidence. Here again it is to be considered why it is that cargoes of cotton should traverse the ocean only to become spontaneously ignited after being stored in English warehouses, when the hold of a vessel is far more favourable to ignition from this cause. The spontaneous combustion of recently-cut hay is observed either soon after it has been stacked or not at all: it is always distinctly indicated by the odour of torrefaction some time before ignition occurs. So far as I know, no one has witnessed the spontaneous combustion of hay, after it has been once dried, when removed and stored in another locality; and yet this is just as probable as that dry Indian or American cotton or jute should ignite in our warehouses without the direct application of fire.

It is stated by those who have extensive commercial relations with articles of which woody fibre is the basis, that if the substance is once thoroughly dried, the subsequent addition of water to it may cause it to heat, but not to ignite. Spontaneous ignition is observed only in certain fibres in the green state. On this point further information, however, is required. Saturation with water after drying tends to operate chiefly by causing decay or rotting of the fibre.

In watching these changes in vegetable matter on a small scale, we may form a conjecture of what happens in large masses, as well as of the source of the heat which sets free aqueous vapour, and creates alarm by its being mistaken for the smoke of combustion. I placed in close vessels, at a temperature of 60°, jute, withered oak-leaves, partially decayed sawdust, and cocoa-nut fibre, wetted. In forty-eight hours, in each case, the oxygen of the air had been sufficiently removed from each bottle to lead to the immediate extinction of a burning taper, and this gas had been replaced by carbonic acid. The vegetable matter had lost carbon, and the air in contact with it, oxygen. Such changes could not take place without the production of heat, although in operating on such small quantities, the increase of temperature did not admit of measurement.

In a large heap this process of oxidation goes on on a larger scale, and the heat manifests itself not merely by the rising of the thermometer, but by the production of a much larger quantity of aqueous vapour. The greater proportion of the heat is no doubt carried off by the vapour; that which remains is rendered sensible in the mass by the non-conducting nature of the material. A free exposure to air by a frequent change of surface tends to keep down this temperature, and thus to prevent its rising even to the torrefying point of 500° or 600°.

These remarks apply equally to manure-heaps, which always contain a large proportion of vegetable fibre in the form of straw as well as excrement. These heaps become so hot as to evolve much steam; but although the dry materials are perfectly combustible, the manure does not spontaneously ignite. In this case there is putrefaction of animal substances as well as fermentation and decay (eremacausis) of vegetable matters; but as both processes lead to the production of heat, this cannot affect the result. Oxygen is always necessary to decay or eremacausis. It is absorbed by decaying bodies, and the result is a slow combustion, applying this term in the wide meaning assigned to it by Liebig ('Organic Chemistry,' p. 230). Decay is simple oxidation; fermentation implies spontaneous changes in organic substances in which gaseous products without odour are evolved; putrefaction, on the other hand, implies the spontaneous decomposition of bodies which emit gases of a disagreeable smell. Oxidation, however, goes on in some cases of fermentation, as well as in putrefaction, and heat is evolved in a proportionate degree. In a manure-heap oxygen is only slowly absorbed—the heat never reaches a high degree; and a large portion of it is carried off as it is produced, by the aqueous vapour into which it converts the water of the organic compounds.

The decay or eremacausis of vegetable substances is a decomposition analogous to the putrefaction of azotized bodies (Liebig); and, according to the same authority, all putrefying bodies pass into the state of decay when exposed freely to the air, and all decaying matters into that of putrefaction when air is excluded (Op. cit. p. 270). No absolute distinction can be drawn; the carbon is converted into carbonic acid by oxidation in decay and putrefaction, and a proportionate amount of heat is evolved.

Azotized substances—or those organic matters, whether vegetable or animal, which contain nitrogen—are liable to fermentation; but it is not usual to hear of the heat reaching the kindling-point. Damp *corn*, *barley*, or *oats* will ferment and become heated. MM. Chevallier, Ollivier, and Devergie were consulted in a case in which a barn containing a quantity of oats had been destroyed by fire. It was supposed by the proprietor to have been an act of incendiarism; but M. Chevallier and the other experts drew the conclusion from the whole of the facts, that it was the result of spontaneous combustion from the fermentation of the grain which had been stored in the barn in a damp state ('Ann. d'Hyg.' 1841, vol. 1, p. 309). The grounds for this opinion were based chiefly on the facts—1st, that the oats were proved to have been stored in the barn in a damp state; 2ndly, that the middle portion of a large pile of sheaves was blackened and charred, while the outside had preserved its natural colour and appearance; 3rdly, that some of the sheaves which on the day before the fire, had been removed to another building, for threshing, presented the same carbonized appearance and colour; and 4thly, that for some days previously the labourers had perceived that the oats were so hot as to alarm them. The length of time which the oats had been in the barn is not stated, but the facts above mentioned were such as to be consistent with the theory of spontaneous combustion. It is obvious that all such cases require a very close and, indeed, exhaustive process of inquiry before the results are assigned to this cause. The destruction of corn by fire in barns and stacks is frequent enough in this country, but it is generally traceable to the acts of incendiaries. Spontaneous combustion has not been raised as a defence, because, probably, all the proved circumstances were adverse, and there were no facts to support the theory. The storage of damp corn, fodder, hay, &c. in barns, is in Chevallier's opinion not an unfrequent source of fire as a result of heating and spontaneous ignition (Op. cit. pp. 321, 323); and he believes that acts of incendiarism are often wrongly imputed, when the facts would admit of explanation by reference to this theory. On the other hand, there are cases of incendiarism which, unless the facts were all known, might be wrongly imputed to spontaneous combustion. I was once present at the Chelmsford Assizes at the trial of two men for arson. They had attempted to burn down a barn containing sheaves of corn. From an examination of the premises it was clear that no one had broken into the barn, and no light had been used by the labourers. The sheaves of corn were only partially burnt about the centre, and the fire had not spread to other sheaves, owing to an intervening space. The evidence showed that part of a plank had been torn off from the outside of the barn, near the ground, and that some lighted lucifers had been introduced through this hole from the outside upon the chance of firing the corn. Some of the lucifers entire and some partly burnt, with the torn half of the sandpaper bottom of a match-box, were picked up near the hole. The two men who were arrested were found to have similar lucifers about them, and in the pocket of one was found the other half of the sandpaper of the box. The torn portions exactly fitted, and completed the bottom of the box. But for this accidental discovery it might have been plausibly contended that this was a case of spontaneous combustion.

In these cases there would probably be true fermentation, the gluten in the vegetable juices operating as a ferment. The process of malting is a familiar instance of the fermentation of barley. The wet grain becomes spontaneously heated by exposure to air; carbonic acid and aqueous vapour are given off, and the constituents of the seed undergo certain chemical changes. So far as I know, grain in malting has never acquired a sufficient temperature even to torrefy itself, much less to ignite spontaneously. Chevallier thinks it may take fire spontaneously after it has been dried, but he adduces no case to support this opinion (Op. cit. 375).

In freshly-cut *hay*, the vegetable juices contain azotized or nitrogenous principles, which, as in grain, may pass through a stage of fermentation. If stacked early in large quantity, this fermentation will notoriously lead to the production of a high temperature, charring, and spontaneous ignition on the admission of air. Although commonly treated as similar cases, the chemical conditions are different from those which are met with in dried woody fibre (such as flax, jute, or straw) wetted with water. There is no ferment in these cases—the process is simply one of oxidation, and the heating does not go beyond the temperature of boiling water, even if it reaches this.

The spontaneous combustion of vegetable matter has been frequently admitted upon insufficient evidence. Chevallier enumerates, among other substances as being liable to this accident, decayed leaves collected in forests, manure-heaps, and the pulp of potatoes; but as some of the instances adduced date as far back as 1758, and no recent cases have occurred, the statements must be considered as untrustworthy. (Op. cit. pp. 356, 362.) The 'Journal de Chimie Médicale,' of which he is editor, contains the reports of only two instances of the spontaneous combustion of vegetable matter during a period of twenty years (see p. 608). There can be no doubt that large heaps of wet leaves undergo a process of heating which has been elsewhere described as oxidation or rotting (p. 612), but no one has ever observed this to reach a temperature of actual ignition. In reference to tobacco-leaves, which during manufacture undergo fermentation, Chevallier furnishes an answer to these loose statements regarding spontaneous combustion. When the dried leaves of tobacco are moistened with water, tied in small bundles, and then heaped together, fermentation soon commences in them; oxygen is absorbed, the leaves become warm, and emit the peculiar smell of tobacco and snuff. If too high a temperature is avoided, the smell increases and becomes more delicate. According to Liebig, the powerful poison *Nicotina* is the product of this fermentation ('Organic Chemistry,' p. 291). In making inquiries in the French tobacco-factories, Chevallier found that in the double fermentation of the leaves, there was no instance recorded in which they had ever undergone spontaneous ignition. The temperature which the piles of leaves acquired did not exceed 176° (Op. cit. p. 363). This, among other facts, tends to show that the spontaneous heating of a substance may take place without necessarily advancing to the very high temperature required for its combustion.

Dry wood is supposed to have the property of igniting spontaneously. Deal which has been dried, by contact or contiguity with flues or iron pipes conveying hot water or steam at 212°, is supposed to be in a condition for readily bursting into flame when air gets access to it. The destruction of the Houses of Parliament, and numerous fires in public and private buildings, have been assigned to this cause. Wood which has decayed, and is then dried in an oven or by a fire, is as inflammable as a pyrophorus, according to Chevallier (Op. cit. p. 276). That pine or other resinous wood which has been for a long time in contact with bodies having a temperature of from 100° to 300° should lose all its water and become highly combustible, like dry flax or jute, is no doubt true. That it should ever acquire the property of taking fire below its igniting temperature in air (1000°) is unproved and untrue, so far as we can speak from experience. That it should ever reach this burning temperature spontaneously, and without contact with air, brick, or metal heated to 1000° or upwards, is a view unsupported by any known facts. I have exposed the thinnest deal-shavings in contact with iron pipes at a temperature varying from 150° to 200° for some weeks without producing combustion, torrefaction, or any change indicative of an approach to either condition. In the patent desiccating process for timber I have seen joists and beams exposed for many days to a temperature of from 200° to 300° in heated air without combustion. The most inflammable deal may be plunged into melted lead at 620°, and zinc at 770°, and retained there without igniting. The wood is simply charred where it touches the molten metal, but does not burn. In the accidents said to have arisen from dried wood in or near flues, combustion could only have taken place as a result of a sufficiently high temperature (1000°) applied from without. This may be communicated by a current of hot air, as well as by flame, by bricks or metal heated to redness, but by no heat short of this. The dried wood is in a condition to burn fiercely, but not to ignite spontaneously; or no dwelling-house, locomotive, or steam-vessel would be safe for a single day. The bad construction of flues is the cause of these accidents, and not the spontaneous ignition of wood which has undergone a process of drying by warm air.

In a paper more recently published by Chevallier in the 'Annales d'Hygiène' (1843, vol. 1, p. 99), various instances of supposed spontaneous combustion are referred to, including cases in which the ignition of combustible substances was caused by the friction of wheels or machinery.

ASPHYXIA.

DROWNING.

CHAPTER 50.

ASPHYXIA OR APNŒA—DROWNING—CAUSE OF DEATH—FATAL SECONDARY CAUSES—PERIOD AT WHICH DEATH TAKES PLACE—RESUSCITATION—TREATMENT—POST-MORTEM APPEARANCES—EXTERNAL AND INTERNAL—WAS DEATH CAUSED BY DROWNING?—SUBSTANCES GRASPED IN THE HANDS—WATER IN THE STOMACH—WATER AND MUCOUS FROTH IN THE LUNGS.

UNDER the term *Asphyxia*, or *Apnœa*, are included those forms of violent death in which the act of respiration is primarily arrested (p. 116). These comprise death from drowning, hanging, strangulation, and suffocation; and in this section the fatal effects of lightning, cold, and starvation will also be considered.

According to the Reports of the Registrar-General, the violent deaths registered in London for the three years 1846, 1847, and 1848 were 1091—namely, from poisoning, 162; wounds, 250; and asphyxia (including only drowning, hanging, and strangulation), 679. It is doubtful whether these returns furnish an accurate comparative record; but in all cases it is probable that the deaths from asphyxia are the most numerous; and of all the forms of asphyxia, drowning appears to be the most frequent cause of death. Thus, out of the 679 deaths from asphyxia in the three years above mentioned, 405 were from drowning alone. In Paris drowning appears to be also a frequent cause of violent death. Out of 1766 cases received at the Morgue in ten years, 1414 are reported to have been cases of drowning. Among the other violent deaths, there were 114 by hanging, 56 by suffocation with charcoal, and only 11 by poison. It is to be presumed, that both in London and Paris the fact of finding a body in water is considered, in many cases, to be sufficient evidence of death from drowning, although it is notorious that after the perpetration of murder bodies are frequently thrown into water for the concealment of the crime.

THE CAUSE OF DEATH.

Asphyxia, or Apnœa.—Many opinions have been entertained respecting the manner in which death takes place by drowning. It was at one time supposed that the water which passed into the stomach of a drowning animal had an injurious effect, and operated as the immediate cause of death. This opinion prevailed before the chemical changes connected with respiration were fully understood. It would, however, have been easy to show the insufficiency of this explanation by a simple appeal to facts. Water is not invariably found in the stomachs of the drowned; and, again, it may be introduced into the stomach in much larger quantity than we are accustomed to meet with it in the body of a drowned person, without producing any deleterious effect. The passage of water into the small air-tubes and cells of the lungs has been suggested as a probable cause of death; and recent researches have rendered it probable that water under these circumstances accelerates death. Another theory at one time prevalent was that in the act of drowning there was a collapse of the lungs by the expiration of air. Recent observations have, however, shown that the lungs are more commonly distended, and that they fill the cavity of the chest. Although some air is lost, the penetration of their substance by water causes them to acquire increased bulk.

No doubt now exists among physiologists that death by drowning is primarily due to apnœa (from α priv. and πνέω, I respire), or suffocation; in which condition breathing is impeded, and the blood is circulated in a state unfitted to support animal life, its circulation through the minute vessels of the lungs being sooner or later wholly arrested. Under these circumstances the person lies in a state of *asphyxia* (from α priv. and σφύξις, pulse), *i.e.* he is pulseless or lifeless. Some physiologists employ the terms apnœa and asphyxia as synonymous—*i.e.*, to signify the state of lifelessness induced by the stoppage of respiration—while others consider apnœa to be the first stage of asphyxia. To the gradual arrest of the pulmonary circulation, as a consequence of the suspension of breathing, must be ascribed the gorged or congested condition of the right cavities of the heart as well as of the lungs of the drowned, which is frequently observed in death from asphyxia. The observations of Sir B. Brodie ('Lectures on Pathology,' p. 66) and others clearly prove that the circulation may be carried on for two or three minutes, or even longer, after respiration has ceased, so that there is not a sudden cessation of the heart's action. Asphyxia is induced in drowning owing to a physical impediment to the introduction of air into the lungs. The medium in which the person is immersed acts mechanically, and even more effectually than a rope or ligature round the neck; for although air escapes from the lungs, and water penetrates into the minute air-tubes, yet no air can enter to supply the place of that which has already expended its oxygen on the blood. Hence this fluid must circulate, in the first few minutes after submersion, in a state unfitted for the support of life (unaërated); but the person lives, and is susceptible of recovery within a short interval. After the entire suspension of respiration, the action of the heart gradually slackens, and finally stops. It is at this period of the complete arrest of circulation that asphyxia passes into death. Asphyxia is determined by the period at which respiration is completely arrested; but the point of time at which death from drowning occurs is fixed by the moment at which the action of the heart ceases. This varies considerably, according to age, sex, state of health, and other circumstances. (See page 116.)

When a person falls into water, and is exposed to this kind of death, violent attempts are in the first instance made to breathe: at each time that he rises to the surface a portion of air is received into the lungs, but, owing to the mouth being on a level with the liquid, water also enters and passes into the throat. A quantity of water thus usually enters the mouth, which the drowning person is irresistibly compelled to swallow. In his violent efforts to breathe while his head is under water a portion of this liquid is drawn into the air-tubes and cells of the lungs. The struggle for life may continue for a longer or shorter period, according to the age, sex, and strength of the person; but the result is, that the blood in the lungs is imperfectly aërated, the individual becomes exhausted, and insensibility follows. The mouth then sinks altogether below the level of the water—air can no longer enter into the lungs: a portion of that which they contain is expelled, and rises in bubbles to the surface: an indescribable feeling of delirium, with a ringing sensation in the ears, supervenes: the person then loses all consciousness, and sinks asphyxiated. In the state of asphyxia, while the dark-coloured blood is circulated, convulsive movements of the body take place, and the contents of the stomach are sometimes ejected by vomiting. There does not appear to be any sensation of pain, and, as in other cases of asphyxia, if the person recover, there is a total unconsciousness of suffering during the period when the access of air was cut off from the lungs. I state this from having accidentally experienced all the phenomena of drowning, up to the complete loss of sensibility and consciousness. (See, in reference to the phenomena of asphyxia from drowning, a paper by Mr. Eccles, 'Med. Gaz.' vol. 44, p. 657.)

Some persons who fall into water are observed to sink at once, without making any attempt to extricate themselves. This may arise from the stunning produced by the fall; and if the fall take place from a great height, the effect is probably aided by the forcible compression which the chest then sustains, whereby the lungs become in great part emptied. Should the person be intoxicated or otherwise incapacitated, as by striking his head in falling, he may not again rise. These different conditions under which death may take place will sufficiently account for the difference in the appearances met with in the bodies of those who have died in water. Some medical jurists have considered that they who are submerged while living frequently perish by *syncope* or fainting, and in other instances by what has been termed 'syncopal asphyxia'—a mixed condition. It has been supposed that the state of terror into which a person may be thrown at the moment of submersion would be sufficient to bring on syncope; and this, it was believed, afforded an adequate explanation of the recovery of the apparently drowned, when the body had remained a long time in water. This opinion is to some extent supported by the results of recent experiments on animals. In other cases a fatal result may be accelerated by the impression suddenly produced upon the skin, from the difference of temperature between the body and the water. To those who are not accustomed to water, a sudden immersion produces a great and rapid cooling of the surface, and forces the blood into the internal organs. There is difficulty of breathing, or severe spasmodic respiration, with giddiness and other symptoms, which may render a person powerless to extricate himself. The effect of cold on the skin is seen in the contracted state of the cutis in the bodies of those who have been drowned during the winter.

Some have ascribed death in drowning to a congested state of the vessels of the brain—in other words, they conceive that death takes place in most cases by a species of apoplexy; but there appears to be no reasonable ground for this opinion. A mere fullness of the cerebral vessels is certainly of itself insufficient to justify this view: for upon the same evidence we might pronounce three-fourths of those deaths which are distinctly referable to other causes to be dependent on apoplexy. The obstruction to the passage of the blood through the lungs is sufficient to explain why we meet with congestion in the vessels of the brain in drowned bodies; but the occurrence of this congestion is probably posterior to the interruption of the cerebral functions. The most characteristic appearance of apoplexy — extravasation of blood on the brain—is rarely seen in the drowned; and probably, when it exists, it may be traced to mechanical violence before submersion, or to the head having come in contact with hard bodies beneath the water. Three instances are recorded in which effusion of blood on the brain was found: one was in the case of Leopold, Duke of Brunswick, who was drowned in the Oder during the German war (see Henke, 'Gericht. Med.' p. 327); the second was in a case which occurred in London in 1839; and the third is reported by Casper. A man was drowned in a marsh. There were the usual post-mortem appearances: the membranes of the brain were strongly congested, and blood was effused to the extent of an inch beneath the outer membrane (dura mater). In his experiments on animals, Riedell did not meet with the effusion of blood in a single instance. ('Medical Gazette,' vol. 46, p. 478.) In general, the term apoplexy is applied to those cases of drowning in which there is great fullness of the cerebral vessels; but in most of these there are also the usual signs of death from drowning. (Casper, 'Ger. Leich.-Oeffn.' 1853, vol. 2, p. 110.)

Those who die from apoplexy, concussion, or syncope, at or about the time they fall into water, cannot be said to die from drowning. A person so situated makes no effort to respire, and it is only by interfering with respiration that the water operates. Admitting, then, that in strictness *asphyxia* is the sole cause of death in drowning, these mixed cases are of interest in medical jurisprudence, because the apparent may be mistaken for the real cause. It may be occasionally necessary to determine whether the person really died by drowning or not, *i. e.* whether he was asphyxiated by water or not; since an answer to this question may materially affect the position of a prisoner charged with homicide. The only conclusion at which we can arrive is, that many persons may fall into water, and appear to be drowned, whose deaths have actually preceded their submersion. Again, there may be extensive but latent disease of the heart, which may fully account for sudden death irrespective of submersion. (See 'Lancet,' Nov. 16, 1850, p. 550.)

M. Devergie ('Méd. Lég.,' vol. 2, p. 336) estimates that among one hundred persons who fall into the water, or are exposed to the chances of drowning, the causes of death are:

Asphyxia, pure . . .	25·0	Asphyxia	87·5
——— and Syncope . ——— Cereb. Congestion	62·5		
Syncope, Apoplexy, or Concussion			12·5
			100·0

From this table we learn that out of one hundred bodies removed dead from water, where death was due either directly or indirectly to immersion,—if the body were removed immediately after death, and examined soon after removal, the ordinary appearances of drowning would be present in about 25, they would be imperfectly apparent in about 62, and they would be wholly absent in about 12. (For a full examination of the causes of death in drowning, by Dr. Loeffler, see Henke, 'Zeitschrift der S. A.' 1844, vol. 1, p. 1; also, a paper by Dr. Ogston, 'Med. Gaz.,' vol. 48, p. 291.)

Period at which death takes place.—A witness may be asked how long a time is required for death to take place by drowning. In giving an answer to this question, cases of death from syncope or apoplexy must be excluded from our consideration. In these, circulation and respiration are simultaneously arrested. Some persons who are strong, who are good swimmers, and retain their presence of mind, may support themselves for a length of time in water; while others who are weak, delicate, and unaccustomed to the water, may struggle only for a few seconds, and then sink exhausted and lifeless. There are two very different points involved in this inquiry:—1. How long can a person remain beneath the surface of water without becoming asphyxiated (drowned)? and 2. After what period of entire submersion of the body may we hope to resuscitate a person? In regard to the first point, it may be observed that when the mouth is so covered that air cannot enter, asphyxia supervenes in the course of one or two minutes at the farthest, and the time at which this occurs does not appear to vary materially with the person. Perfect insensibility has supervened after a minute's submersion, and it is probable that in most cases a few seconds would suffice for the commencement of asphyxia. In the case of a healthy diver who was accidentally submersed, at Spithead, in July 1842, for *a minute and a half*, without the power of breathing, at the depth of eighty feet, it was observed that when drawn up, his face and neck were much swollen and discoloured. He was faint but sensible, and recovered under treatment. In August 1864, a diver descended at Falmouth to about the same depth (80 feet). From the time of his making the signal to be drawn up, *two minutes* only had elapsed before he was taken into the boat. He was then quite insensible, but he was able to place his hand across his mouth. His face, ears, and nostrils were covered with blood. He did not speak, but gave a convulsive struggle, and died soon afterwards. It was found, as in the previous case, that the pipe supplying air had burst, and that the valve for the outlet of foul air had become fixed. The difference between recovery and death was, in these cases, represented by the interval of half a minute. ('Med. Gaz.,' vol. 31, p. 90.) Observations made upon divers (sponge and pearl), show for how short a period a human being, even when practised in the art of diving, can continue without breathing. Dr. Lefevre, of Rochefort, found that among the Navarino sponge-divers, accustomed as they were to the practice of diving, there was not one who could sustain entire submersion of the body for *two consecutive minutes*. The average period of entire submersion was seventy-six seconds. ('Med. Gaz.,' vol. 16, p. 608.) According to Mr. Marshall, the best pearl-divers of Ceylon could rarely sustain a submersion of more than fifty seconds. Thus then it would appear, from these and other observations, that asphyxia is probably induced in most persons in the course of a few seconds, and that at the furthest it occurs in from a minute to a minute and a half. But asphyxia is not synonymous with death: and while in many asphyxia may commence at or about the same period of time, there are probably few in whom, under complete submersion, the circulation would be arrested or death take place at precisely the same instant of time. Such a simultaneous arrest of the action of the heart in two persons must be the result of a pure coincidence. This medical question may be occasionally of importance in reference to the presumption of survivorship, as when husband, wife, and children have died from drowning under a common calamity. (See page 123.)

Period for resuscitation.—The second point to be considered is—How long a period of entire submersion is required for death to take place? *i. e.*, When is there no further hope of resuscitating a drowned person? This question is of importance in relation to the treatment of the drowned. The insensibility which is the result of submersion will give to a body which has been immersed only a few seconds or minutes the characters of apparent death; but we are not therefore to suppose that the person is irrecoverably lost, or to desist from applying all the means in our power to restore animation. On the contrary, the means should be applied without delay, even to bodies which have remained so long in water as to afford, physiologically speaking, but little hope of ultimate recovery. A man who neglected the application of these would consign the body to certain death; while, by adopting an opposite course, he might, perhaps unexpectedly to himself, succeed in restoring life. Hence we are not to allow ourselves to be influenced, in the treatment of the drowned, by the shortness of the interval at which death most commonly takes place. Devergie states that it has been found impossible to restore some who had not been entirely submerged for more than a minute, even when the bodies were removed with all the warmth and pliancy of life about them: but, on the other hand, others have been resuscitated who, there was reason to believe, had been entirely submerged for five minutes. Many of the marvellous recoveries reported have no doubt been cases of the resuscitation of persons who had not been entirely submerged, *i. e.* whose heads were not entirely below water for the period alleged. In most of the recorded instances of recovery after alleged protracted submersion, the evidence has rested upon the loose statements of ill-informed persons incapable of making accurate observations on such a subject.

The late Dr. Woolley, who was for many years medical officer to the Royal Humane Society, informed me that in the Society's records he had met with only two cases of recovery after five minutes' submersion. In the Report of the Society for 1840 there are two cases of recovery after a minute and a half, and two after three entire minutes' submersion. In a case communicated to me in 1841, by Mr. Bloomfield, a boy recovered after a submersion of from five to ten minutes: another is reported of a girl, aged two years, after ten minutes' immersion ('Lancet,' July 1841). It is not certain whether the head of the child was under water during the whole of this period. A case of recovery after six minutes' alleged submersion will be found in the 'Medical Gazette' (vol. 29, p. 78), and in another there was partial recovery after a submersion, it is supposed, of at least eight and probably thirteen minutes. In Vol. 31 of the same journal, p. 448, a man is stated to have recovered after having been fourteen minutes under water, but the time was not derived from actual observation. The longest case recorded with any claim to authenticity, is one which occurred to Mr. Jennings. In this a female is stated to have recovered by prompt treatment after a submersion of *twenty minutes* ('Am. Jour. Med. Med. Sci.,' April 22, 1853, p. 348). In my experiments I did not find that an animal could be restored after its body had been entirely submerged for a period of four minutes; and in one instance which fell under my observation, a stout healthy man, who had been submerged five minutes, could not be restored, although he was submitted to treatment very soon after his removal from the water. It has been a general opinion that so long as any spontaneous movement of the heart continued there was a chance of recovery, but this strictly applies to the rhythmical pulsations, and not to the mere convulsive movements of the organ. Sir B. Brodie states, as the result of his observations on animals, that the rhythmical pulsations cease in from four to four-and-a-half minutes after submersion, and that no animal recovered after these had once ceased, although some convulsive movements of the heart manifested themselves for a longer period. ('Med. Chir. Trans.,' 1861, vol. 44, p. 149.) These facts lead to the conclusions—that in drowning life is very rapidly destroyed; that the time within which a person may be resuscitated is subject to variation; but that after five minutes' complete submersion there can be little hope of success by any method of treatment, and even then our efforts would probably fail unless the treatment were commenced immediately on the removal of the body from water. M. Guérard quotes a case in which a young man is said to have recovered after entire submersion for *an hour*. This case is reported to have occurred in 1774, but the evidence on the time of submersion is not satisfactory. ('Ann. d'Hyg.' 1850, vol. 2, p. 306).

These views are in accordance with the experimental results recently obtained by a Committee of the Medico-Chirurgical Society. (Report on Suspended Animation, 'Med. Chir. Trans.' 1862, p. 449.) Thus it was found by the Committee that *four minutes*' complete submersion in water effectually killed dogs, although after removal from water the heart continued to beat from four to five minutes. The continuance of the heart's action furnishes, therefore, no criterion of the power of recovery.

A submersion of a minute and a half was found sufficient to destroy the life of a dog, but after one minute's submersion, and in a large dog after a minute and a quarter's submersion, each animal recovered on removal almost immediately. Other experiments showed that in asphyxia from simple privation of air a dog would recover after four minutes' suspension of breathing; but as in drowning a minute and a half was sufficient to destroy life without any sign of recovery, it was obvious that some additional cause was at work to render drowning as a form of asphyxia more speedily fatal than ordinary suffocation. This was found not to be owing to exhaustion from struggling, from the violent efforts made to breathe, or from the effect of cold in immersing the whole of the body, but to the introduction of water by aspiration into the minute air-tubes and cells of the lungs. This conclusion was derived from the following experiments. Two dogs of the same size were submerged at the same moment, but one had his windpipe plugged, so that no air or water could enter, while the other had not. At two minutes they were taken out together: the one with the windpipe plugged recovered at once, the other died. In three experiments dogs with their windpipes plugged were kept below water for *four minutes*: the animals recovered perfectly when removed from water. (Report, p. 459). An inspection of the bodies at once revealed the difference. In animals simply deprived of air by plugging the windpipe, the lungs were merely congested; but in those which were submerged in their ordinary condition the lungs, besides being more congested and showing ecchymosed points on the surface and in the substance, contained in their bronchial tubes a bloody mucous froth, formed of water, blood, and mucus, which completely filled the small air-tubes. The respiratory efforts made by the animal before death had caused the production of this froth, which formed a mechanical impediment to the entrance of air by the movements of the chest, as in respiration. This mucous froth or foam issued from the lungs on section, and appeared to penetrate their entire substance, which was saturated with water tinged with blood. The lungs were sodden with water, heavy, soft, doughy, retained an impression produced by the finger, and were incapable of collapsing. In the lungs of animals which recovered after a short submersion, little or none of this mucous froth was found in the air-cells. In the fatal cases the quantity was great in proportion to the time of submersion. There is no doubt that it is produced by the violent efforts to breathe which are made within a minute after submersion.

It may be inferred from these results that the power of recovery in human beings has a direct relation to the presence of the mucous froth in the air-tubes, and to the penetration of the substance of the lungs with water. The larger the amount produced, the less the hope of recovery; for when the lungs have undergone these changes they are physically unfitted either to receive or expel air by respiration—they are incapable of collapsing. Hence it is that a state of syncope is favourable to recovery, as in this condition there are no violent efforts at respiration when the head is below the surface of water. In a case communicated by Dr. Woolley to Sir B. Brodie, a girl recovered after having been exactly six minutes under water; but it appeared in evidence that she had fallen into the water in a state of syncope. ('Med. Chir. Trans.' 1861, vol. 44, p. 149.)

Treatment.—The facts above mentioned have a close relation to the treatment of the drowned. The subject is hardly of a medico-legal nature, but occasionally questions have arisen at coroners' inquests in reference to the propriety of the treatment adopted by a medical practitioner. When it is stated that conflicting methods have been apparently equally successful,—that the warm bath and frictions, as well as artificial inflation of the lungs by various appliances, have each succeeded with some, and failed in the hands of others—it will be perceived that there is great difficulty in making a selection or laying down rules. Artificial inflation of the lungs appears *à priori* to be the proper plan for resuscitation: but when we consider the physical state of these organs, in those who have struggled much and have made violent efforts to breathe while under water, it will be obvious that the lungs are frequently not in a condition either to receive or to expel air. The late Dr. Woolley, who had had considerable experience in treating the drowned, informed me that, as a rule, he had seen no benefit from the introduction of air by artificial processes (see 'Med. Gaz.' vol. 17, p. 663), and that the warm bath (at 100°), with frictions to the skin, had been in his hands the most successful means of treatment. When some signs of animation were not elicited by the warm bath, there was but little hope of any other plan succeeding. In a remarkable case of recovery after fourteen minutes' submersion, reported by Dr. Douglas ('Med. Gaz.,' vol. 31, p. 449), warmth and friction were the only means employed. Inflation of the lungs was tried but not persisted in, because it did not appear to be attended with any good effect. Artificial inflation in some form is now, however, generally employed, in addition to the application of warmth and stimulating frictions to the skin. The Committee of the Medico-Chirurgical Society, discarding the use of apparatus which is rarely at hand when most required, recommends the method of inflating the lungs suggested by Dr. Silvester, 'in which the action of the pectoral and other muscles passing from the shoulders to the parietes of the chest in deep inspiration, is imitated. An inspiratory effort is induced by extending the arms upwards by the sides of the head: on restoring them to their original position by the sides of the body, the expanded walls are allowed to resume their previous state, and expiration takes place, the quantity of air expelled being in proportion to that which had been previously inspired' (Report, p. 468). This plan has been adopted by the Royal Humane Society. The Committee have demonstrated by experiment that it is superior to the method recommended by the late Dr. Marshall Hall, inasmuch as it commences with the act of inspiration, while the latter begins with expiration, and it more completely fills and empties the air-cells of the lungs:—1. Remove from the neck and chest all articles of clothing; 2. Wipe the body dry, and cover it with dry clothes; 3. Clear the nostrils, mouth, and throat of all mucous froth, or of substances likely to interfere with free respiration: pull forward the tongue, and keep it in this position, so that it may not fall back and cover the opening of the windpipe; 4. Place the body at full length with the face downwards, the forehead resting on one arm: this is for the purpose of allowing all fluids to flow readily out of the mouth; 5. Ammonia, aromatic vinegar, snuff, or other stimulants may be cautiously applied to the nostrils; and 6. If respiration is not quickly restored spontaneously, then the body should be placed upon its back. with the head slightly raised. The arms should be gently carried outwards and upwards from the chest, raised above the head, and maintained in this position for about two seconds. By this movement air penetrates into the lungs as during the act of inspiration. The arms are now lowered and brought closely to the sides of the chest by which expiration is effected. Pressure on the lower part of the chest-bone (sternum) aids this expiratory action. This movement should also occupy two seconds. These alternate movements of the arms may be repeated from twelve to fourteen times in a minute. All rough handling should be avoided. So soon as any spontaneous respiratory action is observed, warmth may be applied to the skin by the warm bath or otherwise, and stimulating frictions may be used, or simple frictions with warm flannels, &c. Heat should be applied especially to the region of the heart, the loins, soles of the feet, and palms of the hands. When the power of swallowing returns, warm water, alone or with a little brandy as a stimulant, may be given. The patient should then be placed in bed and allowed to sleep.

This treatment should be persisted in for some hours, except in those cases in which the body has been long under water, and is taken out cold and rigid. In Dr. Douglas's case (*supra*), there were no signs of returning animation until after the treatment had been carried on for eight-and-a-half hours. The tendency to restoration is indicated by the occurrence of slight flushing in the face, with convulsive twitchings in the facial muscles, warmth of the skin, gasping or sobbing respiration at intervals, and sometimes convulsive movements of the body and limbs. The unfavourable signs are these:—Complete insensibility, coldness, and paleness of the body; no spontaneous act of respiration; entire absence of pulsation in the region of the heart; the eyelids half-closed, the pupils dilated, the lower jaw stiff, the fingers half-bent inwards, and the mouth and nostrils containing mucous froth, which is continually escaping from them. The chances of recovery are great in proportion to the shortness of the interval between the last expiratory efforts in the state of asphyxia and exposure to the air. In a very large proportion of all cases of recovery after submersion, the act of respiration in the form of sobbing, sighing, or gasping commences spontaneously soon after the person has reached the air, and the only treatment then required is not to interfere with this natural action of the chest. Whatever may be the plan adopted under such circumstances, if recovery take place it is immediately accredited with the favourable results. This is probably the explanation of the fact that means which have succeeded in the hands of one operator have utterly failed in those of another. In the latter case the lungs of the patient were probably in a state unfitted to receive air, and the patient was therefore beyond the reach of any treatment. Considering the kind of treatment to which the bodies of the drowned have been in some instances submitted, there is much truth in the observation of the late Sir B. Brodie—namely, that recovery has often followed not from the means used, but in spite of them! Cases in which the submersion has been short, the respiratory struggles below water slight, and the treatment is applied immediately on removal from water, may be expected to recover; but under opposite conditions recovery is, with rare exceptions, hopeless. In Paris, from 1821 to 1826, out of 570 cases of drowning it is stated that 430 were resuscitated.

It is unnecessary in this place to describe in detail the method for restoring respiration recommended by the late Dr. Marshall Hall. It has been shown by experiment that it is less adapted to the intended purpose than the plan recommended by Dr. Silvester. It does not allow of the introduction of a sufficient quantity of air into the lungs, nor, if introduced, does it provide for its proper expulsion from them. (For a medico-legal examination of these methods of treatment, the reader is referred to a paper by Dr. Tardieu, in the 'Annales D'Hygiène,' 1863, vol. 1, p. 312; also to the 'Medical Times and Gazette,' February 1861, p. 131.)

Death from secondary causes.—Drowning may operate indirectly as the cause of death. Thus it has been repeatedly remarked that persons who have been rescued from water in a living state, and who have apparently recovered from the effects of submersion, have died, in spite of treatment, after the lapse of some minutes or hours: others have lingered for one or two days, and then have sunk apparently from exhaustion. In those who perish soon after removal from water, death may arise either from exhaustion or from the obstruction of respiration by the penetration of water into the air-cells of the lungs. In the case of Mr. *Gudge* (May 1857) death was clearly owing to the secondary effects of submersion. The deceased was removed from the water and conveyed to the Westminster Hospital. He was cold and insensible, but he breathed tolerably well, and had a fair pulse. In about three hours he became conscious, and spoke a little. The insensibility subsequently returned, accompanied by great difficulty of breathing, and he died in about twenty hours from the time of submersion. Dr. Marcet states that spasm of the glottis has been among the severe secondary symptoms in those who have been removed from water apparently drowned. A severe spasm of this kind manifested itself in one case while placing the person in a warm bath. ('Med. Times and Gazette,' February 1857, p. 148.) When death takes place at a remote period, it may be caused by disease; and a question may then arise, whether the disease was produced by the immersion in water or not. Such cases occasionally present themselves before our Courts of Assize. In one of these (*Reg.* v. *Pulham*, Gloucester Summer Assizes, 1845), the prisoner was charged with the death of the deceased by pushing him into a pond of water, from the effects of which he died. The deceased was an old man; he was taken out of the water in an exhausted condition, and died a few weeks afterwards. One medical witness referred death to the effects of the immersion; but as he had not seen the deceased after the violence, and there was no clear account of the cause of death, the prisoner was acquitted. In most of these cases it will be found exceedingly difficult to connect death with the immersion, when the fatal result does not take place until after so long a period of time. We must in such cases rely upon the nature of the disease alleged to have been caused by immersion,—*e. g.* inflammation of some cavity or organ, and its progress until death without intermediate recovery or interference by improper treatment,—as the basis of medical evidence.

POST-MORTEM APPEARANCES.

In conducting the examination of the body of a drowned person, it is necessary to remember that the external and internal appearances vary much, according to the length of time during which the body may have remained in water, or the period that may have elapsed after its removal and before it is examined. Thus, in reference to the bodies of two persons drowned by a common accident, if one is examined immediately and the other is not removed from the water until after the lapse of several days, and is then inspected, the appearances will be different. So, if the two bodies are removed at the same time, and one is immediately examined, while the other is not inspected until a month after removal, the proofs of drowning which may be discoverable in the former, may have disappeared in the latter. A protracted exposure of the drowned body either to water or air, especially if the temperature is high, renders an inspection useless for the purposes of evidence.

1. *External appearances.*—Supposing that the body has remained in the water only a few hours after death, and the inspection has taken place immediately on its removal, the *skin* will be found cold and pallid—sometimes contracted, under the form of 'cutis anserina.' (Ed. 'Med. and Surg. Jour.,' Jan. 1837.) Casper considers this to be a usual accompaniment of death from drowning. A contracted state of the skin when found certainly furnishes strong evidence of the body having gone into the water living. The skin is often covered to a greater or less extent by livid discolourations. The face is pale and calm, with a placid expression; the eyes are half-open, the eyelids livid, and the pupils dilated; the mouth closed or half-open, the tongue swollen and congested,—frequently pushed forwards to the inner surface of the lips, sometimes indented or even lacerated by the teeth; and the lips, together with the nostrils, are covered with a mucous froth which oozes from them. Kanzler has noticed in the male subject a remarkable retraction of the penis. In men who have gone living into the water and been drowned, this appearance has been repeatedly observed by Casper and Kanzler: and the former states that he has not met with this condition of the male organ after any other form of death. In strong and robust men it has been found short, and strongly retracted into the skin. ('Ger. Leich.-Oeffn.' ii. 109.)

The body and limbs of a person recently drowned are usually found relaxed; but cadaveric rigidity appears to come on quickly in cases of drowning, and the body is often stiffened in the convulsed or distorted attitude which it may have had at the time of death. In a case observed by Mr. Beardsley, the body of a man who was drowned under ice, was found with the arms stiffened in the attitude in which he was endeavouring to support himself on the ice (p. 23). A medico-legal question may arise in reference to this condition of the body,—namely, whether the act of drowning is likely to produce a convulsed or contracted state of the limbs. In the case of *The Queen* v. *George* (Hereford Lent Assizes, 1847), a woman was indicted for the murder of her infant child by drowning it. When taken from the water (in the month of December), about nine days after the supposed murder, there were no marks of external violence. The arms and legs were contracted, and the hands closed. On inspection, the vessels of the brain were congested, the lungs were collapsed, and there was farinaceous food in the stomach, partially digested. The state of the windpipe, and the presence or absence of mucous froth, are not referred to. It will be seen from this description, that there was no appearance to indicate death from drowning with any certainty; and the medical witness admitted, that but for the discovery of the body in water, a suspicion of death from drowning would not have been entertained. From the state of the brain, death might have been caused by convulsions. The defence was, that the child had probably died of convulsions, and that, in order to dispose of the body, the prisoner had stripped it of its clothes, and thrown it into the water after death. The medical evidence failed to show that the child had died from drowning, and the prisoner was acquitted. The contracted state of the child's limbs appears to have created a difficulty in the defence. The clothes of the child were neither cut nor torn, and the witness considered, that had the limbs been so contracted as they were when the body was found, these could not have been removed without cutting or tearing. The medical question therefore was, whether the state of the child's limbs did not prove that it had been put into the water while living. As the usual appearances of death from asphyxia were entirely wanting, it is proper to consider whether there may not be some explanation of the facts consistently with death before immersion. The admission made by the witness in cross-examination, appears to supply all that is necessary for this explanation. If the child had died of convulsions, if the clothes were then removed, and the body thrown in immediately, the sudden effect of the cold water might have occasioned the contraction of the limbs; or the child may not have been really, but only apparently dead when the mother stripped it. If some time had elapsed before immersion, so that the body had become cold, then the limbs would have been found either relaxed, or stiffened in a straight position. The persistence of this contracted state for so many days may be explained by the immersion having taken place at the coldest season of the year. The changes produced in the bodies of the drowned by putrefaction in water have been elsewhere described. (See pp. 80 and 82.)

Among external appearances, it has been noticed that the fingers and surface of the body occasionally present *abrasions*. Gravel, sand, mud, weeds, or other substances may be found locked within the hands or nails of drowned persons; for in the act of drowning, as common experience testifies, a person will grasp at any object within his reach, and in his efforts to extricate himself he may excoriate or wound his fingers. Substances floating in the water are also sometimes found in the nose, mouth, and ears. There are, however, many cases of drowning in which such appearances do not exist. There may be no substance for the drowning person to grasp: this will depend in a great degree upon the fact of the water being deep or shallow, of its being confined within a narrow channel or not, and many other contingencies. In all cases, when the person is senseless before he falls into the water, or when his death is occasioned by syncope, he will, of course, be incapable of making those exertions which are necessary to the production of this appearance, and it is probable that this frequently occurs among females who are accidentally drowned. When the body has remained several days in water, the skin of the palms of the hands and soles of the feet is found thickened, white, and sodden, as a result of imbibition.

2. *Internal appearances.*—On examining the body of a recently drowned subject, the lungs and heart present the appearances usually indicative of asphyxia. The venous system is generally gorged with dark-coloured liquid blood. If death has not taken place from asphyxia, or if the body has remained a long time in water before an inspection is made, the lungs and heart will not present the characters about to be described. Some physiologists have asserted that the *blood* remains fluid in the bodies of the drowned. Orfila has stated that, with one exception, he had not met with blood in a coagulated state. Much more importance has been attached to this appearance than it really merits. Some observers have found the blood coagulated in the drowned, and I have repeatedly seen coagula, like those usually met with after death, in the bodies of animals which were drowned for the sake of experiment. If the blood is found generally liquid, this may be due to the imbibition of water, or to putrefactive changes. Riedell found the blood in the heart and large vessels to contain coagula, in inspections made from two hours to five days after death. ('Med. Gaz.,' vol. 46, p. 478.) The state of the blood in the drowned formed a subject of enquiry in *Reg.* v. *Barker and others* (York Winter Assizes, 1846). From the remarks above made, it will be perceived that it may be found either coagulated or uncoagulated in those who go into the water living, and die by drowning.

Riedell found the epiglottis commonly erect. The *lungs* are more or less congested, and more generally distended than collapsed. Casper and Kanzler, as a rule, found them much increased in volume, and completely filling the cavity of the chest, so that when the chest was opened they protruded out of it. This did not depend on mere congestion or fullness of blood. Casper states that he met with a similarly inflated condition of the lungs in cases in which death had been caused by poisonous gases. ('Klinische Novellen,' 1863, p. 543; and 'Ger. Leich.-Oeffn.,' vol. 2, p. 112.) The most accurate observations in recent cases of drowning show that the lungs are distended—in a flabby condition, and that, owing to the penetration of their substance by water, they have lost their usual elasticity. Hence an impression made upon them by a finger is preserved, as in an œdematous limb. Riedell long ago pointed out this flabby and dilated condition of the lungs as a special characteristic of drowning. Owing to their structure being penetrated by water, he found that, although they floated, they were three or four times as heavy as in their natural state. ('Med. Gaz.,' vol. 46, p. 478.) The lungs are usually in the condition of imperfect expiration, and from the large quantity of fluid in them, the chest does not readily collapse. The observations of Riedell on the state of the lungs in the drowned have since been fully confirmed by the experiments of the Committee of the Medico-Chirurgical Society. On making a section of any part of the lungs, a bloody frothy liquid escapes—air and water being mixed together in the air-cells. The appearances above described are only likely to be observed, in a well-marked form, when the body is examined soon after death. The *windpipe*, *bronchi*, and minute *air-tubes* of the lungs, in a recently drowned subject, are filled more or less with a *mucous froth*, tinged with blood, as a result of the last violent efforts at respiration, when the mouth has sunk below the level of water. (See page 622.) This appearance is not always met with. Thus it is stated not to have been found in the bodies of those who have sunk at once below the surface, and have not again risen to breathe. But from recent experiments on animals, made by a committee of the Medico-Chirurgical Society, its presence in the air-passages does not depend on the fact of a person rising to the surface—although this may increase the quantity,—but rather upon the violent spasmodic efforts made to breathe, under circumstances in which water alone can enter the lungs. A dog was kept entirely under water for three minutes and a quarter. It made the usual convulsive efforts to breathe while in the water, but not after removal from it, as the animal was then dead. A bloody froth escaped from its mouth, and on inspection its lungs were found to be filled with this froth. Another dog was submerged for a minute and a half. When removed, it opened its mouth, but was unable to make any respiration: it was dead. A large quantity of bloody froth was found in the air-tubes and lungs. A dog was kept with its head below water for one minute, and it recovered when withdrawn from the water. An hour afterwards it was inspected, and there was but little froth in the lungs. These facts show that the mucous froth is produced, even in two minutes, when there is entire submersion of the head; and its quantity appears to be in proportion to the length of submersion, and the violence of the efforts made to breathe.

The presence of mucous froth in the air-passages may be regarded as a characteristic of asphyxia by drowning. When discovered in the lungs, associated with a watery condition of these organs, it furnishes a satisfactory proof of this mode of death. As its presence depends on the retention of air in thin vesicles diffused through the air-tubes, it is obvious that, except in recent inspections, *i. e.* within one or two hours of death, it may have wholly or partly disappeared. Water passing in and out by the windpipe may destroy it—also the exposure of the body to a high temperature. This may account for the fact that it is not always observed in the inspection of the bodies of the drowned, when removed from water. A similar appearance is stated, by Orfila, to have been found in the bodies of those who have been hanged, or who have died from apoplexy; but this statement has not been confirmed by general experience. Violent efforts at respiration may, however, produce it—especially if, owing to the loss of power of swallowing, any liquid should find its way into the windpipe. A case of poisoning by laudanum is reported, in which water containing sulphuric ether was forced down the throat of a person after the power of swallowing had nearly ceased. On dissection a quantity of reddish-coloured froth was found, filling up part of the windpipe. Independently of the presence of *water* (sometimes mixed with mud, sand, or weeds) in the larger air-tubes, a portion of this liquid is generally drawn into the lungs by convulsive efforts at respiration. It fills the cells, and penetrates the substance of the organs, giving to them that flabby or doughy consistency above described. In some cases the contents of the stomach may be found in the windpipe and lungs: this occurs when a person has been drowned with a full stomach. Vomiting takes place, and the vomited matters are drawn into the lungs by the attempt to breathe. The state of the *heart* in the drowned has given rise to some discussion. In asphyxia the right cavities are generally found to contain blood, while the left cavities are either empty, or they contain much less than the right. Out of fifty-three inspections made by Dr. Ogston, the right cavities were found empty only in two cases, and the left cavities empty in fourteen. ('Med. Gaz.,' vol. 48, p. 291.) In a case of drowning which was examined by Mr. Bishop, the right side of the heart contained scarcely any blood; and in another case, communicated to me December 1857, the only medical difficulty regarding death by drowning, presented itself in an emptiness or non-distension of the right cavities of the organ. The facts and observations accumulated by my friend Dr. Norman Chevers, of the Calcutta Medical Board, show that a full condition of the heart, although a common, is not an invariable concomitant of asphyxia, either from drowning or any other cause. ('Medical Jurisprudence for India,' 1856, p.

441.) It has been elsewhere remarked, that the action of the heart continues after the stoppage of respiration, and that the period at which this organ ceases to contract is variable (p. 116). Hence, in some cases there may be sufficient power in the right cavities to contract upon their contents, and to expel, more or less completely, the last traces of blood received by them from the body. Emptiness of the right cavities of the heart must not, therefore, be regarded as inconsistent with death from drowning; at the same time, it cannot be taken as a proof that the person has died from asphyxia. Dr. Riedell states that in half the number of instances which had fallen under his observation, the two sides of the heart contained equal quantities of blood; in the other half, the right side contained the larger proportion. In one case only the emptiness of the left side contrasted strongly with the fullness of the right.

A greater or less fullness of the vessels of the *brain* is described as one of the appearances met with in drowning; but this, when it exists, is probably a consequence of a congested state of the lungs. Some remarks have been already made on this subject, and from these it is evident that the state of the cerebral vessels can afford no presumption that death has taken place by drowning. In regard to the cases which I have had an opportunity of examining, the quantity of blood contained within the cerebral vessels has rarely been so great as to call for particular notice.

In examining the abdomen, it will commonly be found that the *stomach* contains water, which appears to enter into this organ by the act of swallowing during the struggle for life. This may be salt or fresh, according to the medium in which the drowning has taken place. The quantity is subject to great variation: sometimes it is large, at other times small, and in some instances no water whatever is to be met with. The absence of water may probably indicate a rapid death, as there could have been no power to swallow. Orfila has remarked, that the mucous membrane of the stomach and bowels is occasionally much discoloured in drowned subjects. He observed also, that when drowning took place while the process of digestion was going on, the mucous membrane of the stomach often had a pinkish, red, or violet tint. When the dead body had remained a long time in water, this membrane was observed to acquire a deep violet or brown colour. A knowledge of this fact will be of importance in those cases in which a person is suspected to have been poisoned previously to submersion. It has been said that the diaphragm is generally much raised towards the chest; but this may depend on gaseous putrefaction, and the increase in the size of the abdomen by the formation of gas in the intestines (p. 81). The urinary bladder in some cases contains urine—in others it is perfectly empty. Casper found it empty in one half of the cases which he examined. It is obvious that the state in which the bladder is found must depend on its condition at the time at which the drowning occurred. (See, in reference to the appearances in the drowned, a paper by Dr. Ogston, 'Med. Gaz.,' vol. 47, pp. 763, 854, *et seq.*; also another by Dr. Riedell, 'Med. Gaz.,' vol. 46, p. 478; and Casper, 'Ger. Leich.-Oeff.,' vol. 1, p. 87; 2, p. 105; and 'Klinische Novellen,' 1863, p. 523.)

Mr. Bishop communicated to me the result of an inspection, made by Dr. Bull of Hereford and himself, in the case of a female whose body had been in the water about an hour and a half. The inspection was made twenty-four hours after death. The contracted state of the skin (cutis anserina or goose-skin) was well marked. The vessels of the membranes of the brain were somewhat congested, the principal seat of congestion being at the base. The tongue was neither swollen nor indented, but pallid. Mucous froth in considerable quantity was found in the windpipe: the vesicles were exceedingly minute in the upper part, but at the lower portion of the tube they were as large as a mustard-seed. A small quantity of clear fluid flowed through the bronchial tubes when the lungs were raised. The lungs were not collapsed: they crepitated on pressure, and were rather bloodless anteriorly; posteriorly they were somewhat gorged with blood, apparently from gravitation. The stomach had about a pint of fluid in it, which seemed to be water mixed with some undigested meat. The lining-membrane was slightly pink in colour. The right side of the heart was very flabby, and contained scarcely any blood. The blood throughout the body was quite fluid. The appearances of asphyxia were not so well marked in the lungs and heart of this subject as they usually are; nevertheless, the state of the windpipe, air-tubes, and stomach was quite characteristic of death from drowning. As a contrast to this, and as showing the variable nature of the appearances met with in the drowned, the following case, reported by Professor Dunglison, is worthy of notice. A woman, in full health, was observed to be intoxicated on the banks of the Schuylkill, U.S., about one hour before her body was discovered in shallow water: she could not therefore have remained long under water. The body was examined by Dr. Farquharson, one of the resident physicians, about sixteen hours after death. The face was swollen, and of a mottled purple colour. The arms and thighs presented patches of discolouration, and a small quantity of whitish froth issued from the mouth, the amount of which was not increased by pressure upon the chest, although a small quantity of watery fluid escaped when the body was turned over. On opening the chest, numerous old pleuritic adhesions were found, on the removal of which, and by the consequent compression of the lungs, a discharge of watery froth took place from the mouth. All parts of the lungs were gorged with blood, and were much heavier and of a darker red colour than in the normal state. The posterior portions of both lungs were more engorged underneath, or from position. The windpipe and air-tubes contained the same kind of watery froth or frothy mucus as that which had issued from the mouth. The liver was large, engorged, and of a bright-red colour. The right cavities of the heart and the coronary veins were filled with dark fluid blood: the left cavities were empty. ('Phil. Med. Examiner,' March 1845, p. 169.)

The late Mr. Semple, of Islington, reported in the 'Lancet' (May 29, 1841), two cases of drowning, in each of which he had made a careful inspection. The subjects were both adult females. In one the cerebral vessels were nearly empty,—the lungs rather voluminous: the bronchial tubes containing a small quantity of frothy mucus,—and the right side of the heart contained a quarter of a pound of fluid blood. There were slight marks of inflammatory redness about the mucous membrane of the stomach and intestines,—accounted for in the stomach by digestion going on at the time of death: the organ contained about a quart of fluid matter, consisting of food mixed with water, probably swallowed in the act of drowning. There were no traces of poison in the stomach, nor marks of violence on the body. In the other case, the eyes were half-open, hands not clenched, fingers straight—the vessels of the brain very much congested. The lungs were distended, the windpipe was empty, and the air-tubes in their smaller ramifications were filled with a soapy tenacious mucus. The right side of the heart and larger veins were distended with fluid blood. The gullet contained a clear watery fluid,—the stomach three ounces of a clear fluid destitute of smell and colour, with the exception of a green tint from a minute quantity of vegetable matter, resembling the confervæ of ponds. The liver was much congested. This woman was found drowned in a shallow pond. The body in each of these cases was examined recently after death.

WAS DEATH CAUSED BY DROWNING?

For a correct solution of this question, it will be necessary to consider the appearances met with in the drowned, and to determine how far they are characteristic of this form of death. Among the *external* signs of drowning, when the body is seen soon after death, are paleness of the surface, a contracted state of the skin (cutis anserina), and the presence of a mucous froth about the nostrils and lips. The absence of these appearances, however, would not prove that the person had not been drowned; for if the body had remained some time in water, or if it has been long exposed to air before it is seen by a medical man, the skin may undergo various changes in its condition and colour, and mucous froth may no longer be found adhering to the nostrils and lips.

State of the skin.—The goose-skin or cutis anserina which is frequently observed in the drowned, shows that the skin possessed the living power of contractility at the time of immersion. Wagner suggests that the appearance might be produced in a dead body if thrown into cold water immediately after death, *i. e.* while the skin is warm. As none but assassins would be likely to resort to this proceeding, the objection would, if admitted, leave the fact of drowning still to be made out by an internal inspection. This contracted condition of the skin could hardly be mistaken for a naturally rough or horny skin, as suggested by Casper ('Ger. Leich.-Oeffn.' vol. 1, p. 89). As this condition of the skin is not invariably present, even in the recently drowned, and as it is observed chiefly in drowning during cold weather, its absence must not be taken to negative the hypothesis of drowning.

Substances grasped in the hands.—In speaking of the *external* appearances of the body, it was stated that foreign substances are sometimes found locked within the hands or lodged under the nails of drowned subjects. This fact may occasionally afford strong circumstantial evidence of the manner in which a person has died. If materials are found grasped within the hands of the deceased which have evidently been torn from the banks of a canal or river, or from the bottom of the water in which the body is found, we have strong presumptive evidence that the person died within the water. For although it is possible to imagine that the deceased may have struggled on the bank, and have been killed prior to submersion, yet in the value attached to this sign we are assuming that there are no marks of violence on the person, nor any other appearances about the body sufficiently striking to lead the examiner to suspect that death had occurred in any other way than by drowning. If the substance locked within the fingers or finger-nails is sand of the same character as that existing at the bottom of the river or pond, it is difficult to conceive any stronger evidence to establish the fact of death having taken place subsequently to submersion. The abrasion of the fingers is a circumstance of minor importance: no value could be attached to this state of the fingers as an indication of a person having perished by drowning, unless it were in conjunction with the appearances above described. A witness would be constrained to admit, in many cases, that the fingers might become abraded or excoriated after death, or even before submersion; while in no case could he be called upon to make, in regard to substances found grasped within the hands, an admission which would invalidate the evidence deducible from this condition. This must be regarded as a satisfactory proof of a person having been alive after his body was in the water. It is well known that when two or three are drowned by the same accident, they are not unfrequently found clasped within each other's arms,—a fact which at once proves that they must have been living when submerged: so if a dead body is discovered still holding to a rope, cable, or oar, no further evidence is required to show that the deceased must have died by drowning.

The internal appearances upon which medical jurists chiefly rely as proofs of death from drowning are—first, water in the stomach; and secondly, water with a mucous froth in the air-passages and lungs.

1. *Water in the stomach.*—Dr. Riedell found that in the majority of cases of drowning water passed into the stomach. In animals previously killed, and

placed for twenty-four hours in water with the mouth wide open, no fluid penetrated to the stomach. ('Med. Gaz.,' vol. 46, p. 478.) Water commonly passes into the stomach of a living animal while drowning as a result of the act of swallowing. It has been observed, that when an animal is stunned prior to submersion, water does not pass into the gullet, and when syncope occurs none will be found. As a proof that its entrance into this organ depends on the act of swallowing, it may be stated that the quantity in the stomach is greater when an animal is allowed to come frequently to the surface and respire, than when it is maintained altogether below the surface. The power of swallowing is immediately suspended on the occurrence of asphyxia, and in this way we may satisfactorily account for the difference observed in the two cases. The water thus found is in variable quantity: and there are some cases of drowning in which water is *not* present in the stomach. It was found by Dr. Ogston, of Dundee, in five cases out seven. (Ed. 'Med. and Sur. Jour.,' Jan. 1837.) In dissecting cats which had been drowned, I have repeatedly remarked the absence of water from the stomach: in these instances the animals had been invariably kept under water from the first moment of their submersion, and thus in a condition but little favourable to the power of swallowing. Water does not readily penetrate into the stomach of a body which has been thrown in after death; the sides of the gullet applying themselves too closely to each other to allow of the passage of fluid. If putrefaction has advanced to any extent, it is possible that some water may enter; but a medical man will easily judge, from the general state of the body, how far this process may have been concerned in the admission of fluid into the stomach and intestines. Orfila has suggested that water may be found in the stomach of a person apparently drowned, in consequence of this liquid having been drunk by the deceased, or artificially injected by another into the stomach after death. It is difficult to conceive under what circumstances the latter objection could be made, or what purpose it would answer. In relying upon the presence of water in the stomach, it may be admitted that the deceased may have drunk water before his body was submerged. The body of a child, aged two years, was taken out of a piece of water and inspected. The usual appearances of drowning, with one exception, were absent. There was no congestion in the brain or lungs, there was emptiness of the cavities of the heart, no water in the air-passages, and thus a want of evidence of death from apoplexy or suffocation. The blood was of a clear red colour, and very fluid: the stomach was almost filled with water, in which a portion of the food floated. No cause of violent death was apparent on inspection. The presence of water in the stomach was explained by the fact that the child had been playing with its nurse on the banks of the stream. It complained of intense thirst, and the nurse gave it a copious draught of water. Almost immediately after this, the nurse having walked away, the child must have fallen from the bank into the water. (Casper, 'Ger. Leich.-Oeff.,' vol. 1, p. 91.) The discovery of water in the stomach, except under circumstances to be presently mentioned, is not, therefore, a necessary proof that it has been swallowed during the act of drowning.

It is of course presumed that the liquid contained within the stomach is of the same nature as that in which the body is immersed; for it is possible that fresh water may be found in the stomach of a person drowned in salt-water, and in such a case it would be obviously improper for a medical witness to affirm from the mere presence of water, that the person had died where his body was discovered. If the water contain mud, straw, duckweed, moss, or any substances like those existing in the pond or river where the drowning occurred, this is a proof, when the inspection is recent, of its having been swallowed by a living person. In the case of

Mary Ashford (*Rex* v. *Thornton*, Warwick Summer Assizes, 1817), some duckweed with about half-a-pint of water was found in the stomach of the deceased. The body was discovered in a pond in which duckweed was growing. This fact sufficed to prove that the deceased must have been living when immersed. The following case occurred at Maidstone in July 1843. The body of a young woman was found in the Medway under circumstances that led to a strong suspicion of murder. The medical witness deposed that there were no marks of external violence, nor any sign of the deceased having struggled with the supposed murderers. There was some long grass at the back of the mouth, and in the throat. The grass was not the same as that growing on the banks of the river, but such as grew at the bottom, which the deceased had probably swallowed after having gone living into the water. On this evidence the accused was discharged. In another case investigated by Mr. Image (*Reg.* v. *Carnt*, Bury St. Edmunds Lent Assizes, 1851), the body of deceased was found with her head among water-weeds, some of which were discovered in her throat, and the finger-nails were filled with sand and mud, as if clutched convulsively. These facts aided in proving that deceased had died from drowning. The absence of water from the stomach cannot, however, lead to the inference that the person has not died from drowning, because in some instances it is not swallowed, and in others it may drain away and be lost after death before an inspection is made.

2. *Water with mucous froth in the air-passages and lungs.*—If the body is removed from the water with care, and is examined at a sufficiently early period, these appearances will furnish satisfactory evidence of death from drowning. The mucous froth is generally tinged with blood; its mode of production has been elsewhere described (p. 627), and other conditions have been pointed out in which such an appearance may be produced. Dr. Riedell regards it as a constant sign of death by drowning. In all his experiments and observations he states that he found a frothy fluid in the windpipe, bronchi, and lungs. After death it gradually disappeared from the air-tubes by exosmosis, but not from the lungs. The fluidity of this froth is, he contends, a distinctive character of death by drowning, and is not met with in any other form of death ('Med. Gaz.', vol. 46, p. 478). The presence of a frothy fluid would undoubtedly show that liquid, from some cause, had penetrated into the air-passages; and when taken in conjunction with the presence of water in the substance of the lungs, it may be considered to furnish conclusive evidence of death from drowning. On the other hand, its absence does not necessarily prove that a person has not died from this cause. If none is found in a body recently after death, this may have been the result of syncope or apoplexy, and there may have been no convulsive efforts at breathing prior to death. A mucous froth may not be found when the body has remained for a long period in the water after death, since by the free passage of this fluid into and out of the air-tubes, the froth, although formed in the first instance, may have disappeared. If, after removal from the water, the body is exposed to the air for several days before it is examined, it is rare that this appearance is seen. The mucous froth may have been formed in the windpipe, but it may have entirely disappeared, owing to the incautious manner in which the body has been handled on its removal from water. Thus, if removed with the head depending, any liquid which may be contained within the lungs will escape, and in passing through the air-passages it will remove the froth.

3. *Water and foreign substances in the lungs.*—It has been elsewhere stated that in the act of drowning water is drawn with considerable force into the lungs, by violent attempts at inspiration. The aspiratory force thus exerted by the lungs is considerable. It has been found that when the heads of

animals are plunged below mercury, some of this fluid metal, in spite of its great density, is actually drawn into the lungs, and globules of it have been found in the air-cells. *A fortiori*, this takes place in a greater degree with water which is forcibly drawn into, and permeates the spongy texture of the lungs, rendering death more rapid and recovery more difficult than in other forms of asphyxia. This aspiratory force of the lungs has been measured, and is found, in small animals, to be equal to raising a column of mercury four inches in height. Not only is water thus drawn in, but sand, mud, weeds, or other substances floating in it, are also carried into the air-tubes and cells of the lungs. When the water is mixed with weeds or mud, and water presenting the same admixture is found in the throat and stomach, this is strong evidence that the body has been plunged into the medium when the power of breathing and swallowing still existed, and hence that the deceased has been drowned. An attention to the condition of the stomach and lungs together, will therefore be of importance in cases of alleged child-murder by drowning, since it may aid in proving or disproving the charge. In a case tried at the Central Criminal Court, April 1861, in which I was consulted by Mr. Tyte of Harrow, some greenish-coloured mud was found in the throat, lungs, and stomach of an infant whose body had been removed from a pond. The prisoner was acquitted, chiefly on the suggestion that she might have thrown the body of her child into the water when she believed it to be dead, and one or two gasps might have accounted for the appearances presented by the stomach and lungs! When a dead body is thrown into water, and has remained there some time, water, with fine particles of sand, mud, weeds, &c., may pass through the windpipe into the lungs, and be there deposited. Water under these circumstances, however, does not penetrate into the substance of the lungs as by aspiration during life, and the amount which passes through the chink of the glottis is small. If simply an after-death effect, the water is found in the larger air-tubes unaccompanied by mucous froth. In most cases, however, the effect of aspiration, as a result of living power, is so manifest, that the examiner can have no difficulty in forming an opinion. Dr. Norman Chevers, of Calcutta, was required to examine the body of a child found dead in a tank at a distance from the house of its parents. The internal appearances showed that the child had died from drowning. The air-passages contained green vegetable-matter, and the right air-tube was almost completely filled with so large a portion of an aquatic weed doubled together, that it appeared astonishing how such a body could have passed into the windpipe. It was proved that no weed of this kind was growing in the tank in which the dead body was found; and further inquiry led to the discovery, that the body of the boy had been found by a woman in a tank near his home, in which a weed like that taken from the air-passages grew abundantly. This female conveyed the corpse to the more distant tank, which belonged to a person against whom she bore a grudge! ('Medical Jurisprudence for India,' 1856, p. 351.) The only reasonable explanation of the facts was, that the child must have been living when placed in the tank in which the weed grew, and have drawn it in by its efforts to breathe. Its presence indicated a living act, and that the body was not put after death into the water of the first tank, but when dead it was subsequently carried to the second tank and placed there for a malicious purpose.

A medical man may be occasionally required to express an opinion on the length of time that may have elapsed since the act of drowning, when the dead body of a person has been discovered in water. The rules which have been suggested for the guidance of a medical witness on these occasions are given at page 82. They are open to so many exceptions, owing to the different degrees in which putrefaction takes place in bodies exposed under similar circumstances, that they are but of little service as a basis for medical evidence. On the production of adipocere as a result of the decomposition of the body in water, and the properties of this substance, see p. 84.

CHAPTER 51.

SUMMARY OF MEDICAL EVIDENCE—CASES INVOLVING MEDICO-LEGAL QUESTIONS—SPECIFIC GRAVITY OF THE HUMAN BODY, LIVING AND DEAD—CO-INCIDENTAL CAUSES OF DEATH—MARKS OF VIOLENCE ON THE DROWNED—ACCIDENTAL FRACTURES—WAS THE DROWNING THE RESULT OF HOMICIDE, SUICIDE, OR ACCIDENT?—DROWNING IN SHALLOW WATER—DROWNING FROM PARTIAL IMMERSION.

In the preceding chapter the whole of the evidence which a medical inspection of a drowned body is capable of affording has been brought under review. The only characters on which reliance can be placed, as medical proofs of death from drowning, are—first, the presence of a mucous froth in the windpipe and air-tubes; secondly, of water in the air-tubes and air-cells of the lungs; and thirdly, of water in the stomach. An early inspection of the body may enable a medical man to come to a satisfactory conclusion that death was or was not caused by drowning. The longer this inspection is delayed, the more ambiguous the evidence becomes, since the froth slowly disappears from the air-tubes, while water may penetrate into the lungs and stomach. The great cause of failure in obtaining medical proofs of drowning is generally in the unavoidable delay before an inspection is made. A man died suddenly in the Rue St. Antoine, at Paris, in February 1830, and the body was soon afterwards brought to the Morgue. It there underwent a minute examination; but there were no marks of violence externally, nor was there any appearances of disease internally to account for death. In the course of the inspection it was found that the larynx, windpipe, and air-tubes contained a mucous froth. In the larynx this was white, but it had a red colour in the air-tubes. M. Devergie, who conducted the inspection, states that it only differed from the froth as it exists in the drowned, in the circumstance of its being in larger vesicles; but he candidly owns that, had he not been certain of the contrary, he should have presumed that he was examining the body of a person who had died by drowning. He offers no suggestion as to the cause of this appearance. There was a large quantity of water in the stomach, amounting to almost a pint, and the lungs were gorged with blood, as in cases of asphyxia. Supposing that this body had been thrown into the river after death, it is clear that most medical men, relying upon what are usually regarded as well-marked proofs of this kind of death, would have declared this to have been a case of drowning.

If a case of this kind is of rare occurrence, we may take an instance of a different description. A person may be suffocated, or may die from epilepsy, apoplexy, or from a sudden attack of any fatal disease which may not be indicated by well-marked appearances after death; the body is thrown into or falls into water, and remains there a few days. When taken out, water may be found in the lungs, but there may be none in the stomach; there may be no mucous froth in the windpipe, and the lungs are found more or less congested. How is a practitioner to determine whether death has actually taken place within the water or not? In the case of a suffocated body, without marks of external violence, it would be impossible; since persons may die in water, or at the moment of immersion, under circumstances in which the appearances of drowning would be either obscure or entirely wanting. Dr. Ogston, of Aberdeen, relates an instructive case of death from epilepsy, under circumstances which might have led to a strong suspicion of violent death, from the position in which the dead body was found. A man was in the act of leaving a privy, when he was seized with an epileptic fit, and fell with his face in a piece of dirty water, which did not exceed a foot and a-half in breadth, with a depth of from three to four inches. When discovered after death, only his mouth and nostrils and one cheek were found to have been under water. ('Med. Gaz.,' vol. 47, p. 763.)

If, in examining a body taken from water, we found the appearances of mortal disease, or marks of external violence sufficient to destroy life, there is strong ground for suspicion. Why the body of a person who has really died from *natural causes* should be afterwards thrown into water it would not be easy to explain upon any hypothesis of innocence, but we can readily appreciate the motive when murderous violence has been used. After the lapse of five or six weeks, especially if the body has been removed from the water for the greater part of that period, none of the usual appearances of drowning will be met with: in the present day, no practitioner would think of seeking for evidence under such circumstances. The medical opinions expressed by the witnesses for the prosecution at the trial of *Spencer Cowper*, for the murder of *Sarah Stout* (Hertford Assizes, 1699), are therefore worthy of remark, if only as affording an example of what is to be avoided on these occasions.

The body of the deceased was found floating in a stream about thirteen hours after she was missed. It was buried, and *six weeks* afterwards was exhumed and examined. No water was found in the stomach or lungs, which, it was stated, were not putrefied. Six medical men deposed that when a person was drowned, water was invariably taken into the stomach and lungs; and as none was found in this instance, they were of opinion that deceased came to her death by some other means;—in other words, that, as alleged in the indictment, she had been murdered by the prisoner, and her dead body afterwards thrown into the water! The prisoner, who was a man of education and good social position, asked one of these witnesses whether, after six weeks' time, water would remain in the body? The reply to this intelligent question was, that there should be some, because 'it can't come out after the body is dead *but by putrefaction*; and there was no putrefaction.' The medical witness does not appear to have had the least suspicion that the deceased might have died without swallowing any water, or that the quantity swallowed might have been small, and entirely lost in six weeks by transudation through the soft coats of the stomach and the substance of the lungs. The prisoner was acquitted.

A case presenting some remarkable features in reference to death by drowning was the subject of a trial at the Commission Court, Dublin, in December 1852. (*The Queen* against *W. B. Kirwan*: Report by J. S. Armstrong, Dublin, 1853.) The prisoner was charged with the murder of his wife. He was an artist, and had gone with his wife, on the 6th September 1852, for a day's excursion to a small island not far distant from Howth harbour. When the boatmen who took them over in the morning returned to fetch them, about eight o'clock in the evening, the prisoner only was seen on the shore; and on being asked where his wife was said that he had not seen her for more than two hours, and that she had gone to bathe. After searching for some time the body of deceased was found, about ten o'clock, lying on her back, on a small rock just out of the water, between high and low water-mark, the tide having fallen. Her bathing-shift was on her about her waist, and a sheet was beside her and partly under her: she had on bathing-boots. Her clothes were ten or fifteen yards from where her body was found, on a rock about six feet above the water's edge. It was a spot where ladies were in the habit of bathing. It was stated by several witnesses, that about seven o'clock on the evening on which the body was found, cries or screams, as of a person in distress, were heard to proceed from the direction of the island, and apparently from this spot. The body was only superficially examined the next day by a medical gentleman, and he found abrasions of the skin around the eyes, and a scratch on the right temple. The face was rather pale. Froth issued from the mouth, but there was no appearance of blood mixed with it. There was a stain of blood on the cap, about the size of a five-shilling-piece, which appeared to have come from one of the ears. He saw no wounds or other marks of violence about the body,—nothing to show that the deceased had not died from drowning. On the 6th October (*thirty-one days* after death, and twenty-six after interment) the body was re-examined and for the first time carefully inspected by Dr. Hatchell. It had been lying nearly a month in a wet grave, and was to a certain extent 'macerated.' The water had had the effect of hastening the decomposition of the surface of the body. There was no mark of violence on the scalp: there were abrasions, or marks of scratches, on the prominent part of the right cheek under the right eye. The eyes were protruded from decomposition. There were no injuries outside, inside, or behind the ear: the upper lip was swollen, and the tongue protruded between the teeth: the tongue was marked by the teeth both above and below. There was a sort of soapy matter about the mouth, such as usually presents itself in bodies which are in an advanced state of decomposition. The brain was of a light-pinkish colour, and fluid from decomposition. There was no fracture of the skull, and nothing remarkable in the air-passages. There was a superficial cut or scratch under the nipple of the right breast. There was an appearance of congestion about the organs of generation. The lungs were congested at the back and lower parts, arising from engorgement of blood. The internal organs were not decomposed. The heart was healthy; its cavities, as well as the large vessels leading to it, were empty. The stomach was empty and contracted. The generative organs were carefully examined, but there was no wound in or about these parts.

The cause of death, in the opinion of this witness, was asphyxia, or a sudden stoppage of respiration. Owing to the congested state of the vagina and the engorgement of the lungs, he thought that the simple stoppage of respiration must have been combined with pressure of some kind, or constriction. Simple drowning (*i. e.* drowning alone) would not produce the appearances. The engorgement was greater than he had ever seen in cases of drowning, and he did not think it compatible with drowning alone; but he at the same time admitted that the engorgement was subject to great variation, and might be great if a drowning person struggled to save himself. 'The appearance presented by the lungs must have been caused by struggling. I' (continued the witness) 'think it very likely that the appearance of the vagina would have been occasioned by struggling in the water for life.' The witness was not prepared to say whether death was or was not caused by a sudden fit on the deceased entering the cold water. The prisoner was found guilty, but capital punishment was subsequently commuted for transportation.

The moral circumstances of the case were, as I am informed, strongly adverse to the prisoner. He was of bad moral character, and the account which he gave of the disappearance of his wife was not satisfactory. It was said that the circumstances under which the body was found were such that its position on the rock could not have resulted from any accident. These points of circumstantial evidence, however, rested on the statements of witnesses who differed from each other. As in this case the body was not inspected until a month after death, and decomposition had advanced to a great degree, the medical proofs of drowning, assuming them to have existed recently after death, were lost. Neither the lungs, air-tubes, nor stomach could be expected to present those appearances which are seen in the recently drowned. The absence of these appearances at this long date after death was, however, considered by some medical men to show that deceased had *not* perished by drowning. One theory was that she was smothered; another that she was strangled, and the body placed after death in the position in which it was found; and a third view was that she was accidentally drowned. Considered apart from the moral evidence, the inspection of the body threw no light whatever on the actual cause of death.

The dead body of a person may be found in water under circumstances which may lead to a strong but erroneous suspicion of homicidal interference. The following case occurred in May 1854:—

A gentleman, æt. 30, who had retired to his dressing-room in apparently good health, was for some time missing, and on breaking open the door his body was found lying in a sponging-bath which he was in the habit of using. He was quite dead, but there was still some warmth about the body. He was lying on his face in the bath, with his nose and mouth below the level of the water. Some time before he was thus discovered, a fall had been heard in his room; but no particular notice was taken of it. The body was inspected twenty-four hours afterwards. Externally there was a recent wound of the skin of the right arm above the wrist,—this had apparently been caused by pieces of a washhand-basin which had been broken. There was much congestion of the brain and its membranes. The heart was slightly enlarged, and the walls of the left ventricle were thickened. In the right ventricle only a small clot of blood was found: with this exception the cavities were perfectly empty. There was some cartilaginous deposit in the aortic valves. The right lung was healthy, and presented no congestion: the left was wasted but slightly congested. An inquest was held, when the medical and other evidence tended to show that, although the body was found with the face under water, the deceased had not died from drowning, but that he had been seized by a fit—probably epileptic,—that he had fallen into the sponging-bath, breaking the washhand-basin in the fall, and thus producing the recent wound of the right arm. It turned out that he had previously had two epileptic fits. Mr. Kesteven has related a similar case in which a man who was just about to jump into the water to rescue a boy who had fallen in by accident, was suddenly seized with paralysis and died in three hours. On examination there was effusion of blood on the brain, and this accounted for the apoplectic seizure ('Med. Gaz.' vol. 44, p. 295).

In consequence of the uncertainty attendant on the appearances of drowning, barristers have considerable advantage in cross-examining those medical witnesses who appear to support the theory of the prosecution that death took place from this cause. Legal ingenuity is here often strained to the utmost, to show that there is no certain *sign* of drowning, and therefore that the deceased must have died from some other cause. The general impression among non-medical persons appears to be that, whether in drowning or suffocation, there ought to be some particular *visible change* in some part of the body to indicate at once the kind of death; but it need hardly be said that this notion is founded on false views, and if the reception of medical evidence on the cause of death be made to depend on the production of some such positive and visible change of structure, then it would be better at once not to place the parties charged with the offence upon their trial, because the crime could never be proved against them. A medical inference of drowning is founded upon a certain series of facts, to each of which, individually, it may be easy to oppose plausible objections; but taken together they furnish evidence as strong as is commonly required for proof of any other kind of death. A trial took place at the Central Criminal Court, April 1841, in which the witnesses were severely cross-examined on the appearances caused by drowning. (*The Queen* v. *Longley*.) The mother of the deceased child was charged with murder by drowning it. When the body of the child was removed from the water, its mouth was closed. The prisoner's counsel endeavoured to make it appear that it was most usual to find the mouth *open* in cases of drowning; and then went on to say, 'that the only proof of suffocation by drowning which had been adduced by the medical witness was the mucous froth found in the air-cells: that this could not have gone through the mouth was quite certain, because the mouth was proved to have been closed. The air might have passed into the air-cells of the child whilst struggling in its mother's arms just as well as whilst struggling in water!' After what has been stated regarding the mucous froth, it is not necessary to point out the gross fallacy of the assumptions involved in this argument; but it is much to be regretted, for the interests of justice, that medical evidence should be allowed to be presented to a jury in such a perverted and erroneous form. The state of the mouth did not affect the question of death from drowning. The mucous froth in the air-passages was the best possible evidence of this kind of death. The mouth might have been spasmodically closed before or after its production. It is surprising, when medical facts are so misrepresented in a defence, that even in a case of undoubted criminality (as in this particular instance) a conviction should ever occur. (See also the case of *The Queen* v. *Owen*, *Thomas*, and *Ellis*, Stafford Lent Assizes, 1840.) In a case in which Mr. Image, of Bury St. Edmunds, gave evidence (*Reg.* v. *Carnt*, Suffolk Lent Assizes, 1851), the medical facts, although furnishing conclusive evidence of drowning when taken together, were individually objected to. The deceased was found dead in a pond. The body was removed after it had been lying about four hours in the water, and was carefully examined by Mr. Image forty-one hours after death. The hair was hanging back, wet, very muddy, with leaves and weeds entangled in it; the ears were muddy, the right eye ecchymosed, pupils slightly dilated, lips bluish, and there were bluish patches on the face. Slight scratches were observable on the right side of the face. The skin had a dull leaden hue. The jaws were fixed, teeth tightly clenched, and the tongue not protruding. The nails were filled with sand and mud. There were severe bruises on both arms near the elbow, equal in extent and intensity. The tongue was greatly congested, and covered with froth and mud, which extended backwards to the throat and nostrils as well as into the larynx and windpipe, and the upper divisions of the air-tubes of the lungs. The lungs were engorged and greatly distended: when cut in any part frothy mucus was abundantly poured out, and much liquid escaped on pressure. The heart was healthy; the right and left cavities were filled with black fluid blood. There were no coagula. There were small pieces of green weed in the air-tubes (corresponding to weed in the pond). The vessels of the neck were distended with dark-coloured liquid blood, without any coagulum. The stomach was healthy; it contained partially-digested food, with about a pint of liquid mixed with mud and sand. The liver was enormously congested, bleeding profusely at every section. The bladder was quite empty, and contracted to the smallest size. The sinuses (large vessels) of the brain were not much distended, and the substance of the organ was not greatly congested. Mr. Image gave an opinion, which was perfectly justified by these appearances, that the deceased had died from drowning, and that she had probably been held forcibly under water. The accuracy of this opinion, in spite of this attempt to overthrow it in the defence, was established by the confession of the criminal before execution.

In *Reg.* v. *Griffin* (Shrewsbury Lent Assizes, 1861) the prisoner was charged with the murder of her child by drowning it. The dead body was found on the bank of a river. The defence was that it was dead when she put it into the water. The medical evidence satisfactorily proved that there were no marks of violence externally—only a few abrasions (rubbings of the skin) as the result of accident. There was some sand in the mouth, nose, and ears. The brain was healthy; the membranes were slightly congested. The lungs were congested and contained mucous froth, which was also found in the windpipe mixed with sand, particles of which were seen in the smaller air-tubes. The lungs were fully distended. The heart contained on the right side fluid blood; the cavities on the left side were empty. In the stomach were four ounces of fluid, with some food partly digested. All the organs were healthy. An attempt was made in the defence to refer death to convulsions, but the appearances, taken as a whole, were only consistent with death from drowning. The learned judge in this case asked the medical witness a question for which those who give evidence on death from drowning should be prepared: it was whether he was not influenced in coming to a decision by the fact that the body of the child had been found on the bank of a river. The witness said that he should have come to the same conclusion if he had not known of that circumstance, in which statement he was perfectly justified by the appearances, for there is no disease affecting children which will produce them. If the child had had convulsions, it was still exposed while living to the action of water. The prisoner was convicted.

Specific gravity of the human body.—At the trial of *Spencer Cowper* (ante, p. 636) for the murder of *Sarah Stout*, the buoyancy of the human body, living and dead, formed an important part of the enquiry. The body of the deceased was found floating, at about five or six inches below the surface of water, in a pond which was only five feet in depth. From this circumstance it was assumed that deceased could not have gone living into the water, because—as it was alleged, and attempted to be proved by scientific as well as nautical testimony for the prosecution – the body of every person who died from drowning sank, while a dead body thrown into water immediately after death from some other cause than drowning floated! A sailor was called to support this strange piece of nautical philosophy, and although his statements were contradictory, he swore that in all the battles and shipwrecks in which he had been engaged, he had uniformly observed that those who were drowned sank, while those whose bodies were thrown in dead floated! Hence, he contended, it was necessary to attach weights to the bodies of those who died at sea. 'Why,' said this witness, 'should Government be at that vast charge to allow threescore or fourscore weight of iron to sink every man, but only that their swimming about should not be a discouragement to others?' ('Smith's Anal. of Med. Ev.' 278.) The medical witnesses for the prosecution contented themselves with stating that the bodies of persons who were drowned sank, without taking into consideration that there were circumstances in this particular case which might have accounted for the floating, and have entirely set aside the hypothesis of death before immersion. This was the body of a female, and in females there is less bone and more fat than in males—conditions which tend to render their bodies lighter than water. The deceased was drowned in her clothes, and the clothes of females contain much air, which tends to give the dead body buoyancy for a time. In addition to these facts, there were some stakes near the body, which might have aided in supporting it by the clothes. The presence of a small quantity of air in the lungs, or of gases in the intestines at the time of death should, apart from all other considerations, have prevented the fact of the body floating from assuming the mysterious importance which was assigned to it by the Court and some of the scientific witnesses. Fortunately for the ends of justice, other sailors were called for the defence; and they deposed, that after their battles and shipwrecks, they had always observed the bodies of the dead to sink, whether drowned or not, and that weights were attached to bodies buried at sea, not for the purpose of sinking them, but of preventing them from floating as a result of putrefaction. This view of the question was much nearer the truth. Although it is not likely that the life of any one will ever again be endangered by a question of this kind, it is proper to state a few facts connected with the specific gravity of the human body.

The specific gravity of the human body, in the *living* healthy state, is made up of the combined specific gravities of its different parts; so that, as in all heterogeneous solids, it is a very complex quantity. In the first place, about 72 per cent. of the weight of the body consist entirely of water—hence the question of specific gravity can refer only to the remaining 28 per cent. of dry solids. The only part of the body which is lighter than water is fat. The specific gravity of this is 0·92, and it is calculated that the proportion of fat in an adult is about five per cent. of the weight of the body, or one-twentieth part. The specific gravity of muscle is 1·085, of brain 1·04, of the soft organs generally 1·05, of the lungs containing air 0·94, and of bone, the heaviest part of the body, 2·01. The lightness of the fatty portions is more than counterbalanced by the weight of the skeleton (about ten-and-a-half pounds in the male, and nine pounds in the female), so that the naked human body, placed on water, has a slight tendency to sink. This tendency diminishes just in proportion to the quantity of the body immersed; because all those parts which are out of water, not being supported by water, become so much additional absolute weight to the portion immersed. Hence the frequent cause of death by drowning. An inexperienced person exhausts himself by exertion, raises his arms continually out of the water, and as often sinks, owing to their weight having just so much effect on his body as if a leaden weight had been suddenly applied to his feet to sink him. When the *whole* of the living body is immersed, the specific gravity, owing to the expansion of the chest, differs so little from that of water, that a very slight motion of the hands or feet will suffice to keep a person on the surface. The head, owing to the weight of the bones of the skull, has always a tendency to sink below the level of water. There are two circumstances which cause the specific gravity of the body to vary. If the quantity of *fat* is proportionably large, it will be diminished; and such a person will float more readily than another in an opposite condition. On the other hand, a large proportion of *bone* renders a person heavier than his bulk of water; and his body will sink more rapidly than that of another. These two modifying causes of buoyancy are liable to constant variation; hence the different accounts given by experimentalists relative to the specific gravity of the human body. The bodies of females are, *cæteris paribus*, of less specific gravity than those of males: the skeleton is smaller, and there is a greater proportion of fat,—hence they more readily float. Infants and young children float with the greatest ease; the quantity of fat is usually in large proportion, and the bones are light,—the earthy matter being not yet fully deposited. Thus, in infanticide by drowning, the body of the child rises very speedily to the surface,—if, indeed, it does not remain altogether upon it.

There are some other points to be considered in relation to the buoyancy of the living human body. 1. *Respiration.*—It is the fact of the lungs being filled with air that gives the general lightness to it. If these organs were emptied, and the chest contracted, then the specific gravity would be considerably increased: hence it follows that, *cæteris paribus*, a person with a large and capacious chest floats more easily than one whose chest is small and contracted. Hence, also, in a living person the body has a tendency to rise out of water during inspiration, and to sink during expiration—the quantity of water displaced under these two opposite conditions of the respiratory organs being very different. The entrance into water with the chest nearly emptied as the result of a loud scream or shriek is very unfavourable to the buoyancy of the body.

The fact of *clothes* being on the person may also make a difference—either, from their nature, in serving to buoy up the body, or from their weight to sink it more deeply. Females are sometimes saved from drowning by reason of their clothes floating, and thus presenting a large surface to the water; it is partly owing to this circumstance that the bodies of drowned females often remain floating on the water immediately after death. This happened in the case of *Sarah Stout* (ante, p. 636). In a case of suicide at Plymouth (January 1849), it was proved at the inquest that the body of the deceased floated on the sea-water for half-an-hour after the act of drowning: it was probably buoyed up by the clothes. But it is to be observed that the specific gravity of sea-water is 1·026. This differs but little from the specific gravity of the muscles and soft organs; hence the human body floats much more readily in sea than in fresh water, and indeed, except for the weight of the skeleton, it would have but a slight tendency to sink in the sea. I have found by experiment that every structure of the human body excepting bone, floats in the water of the Dead Sea, which is remarkable for its great specific gravity (1·117.) I am indebted to Mr. W. J. Cooper, Coroner for Portsmouth, for the account of a case in which a drunken man, æt. 40, who had gone to bathe in the sea was accidentally drowned. His body did not sink. It was observed to be floating with the face downwards, and the mouth below the level of the water: when turned over, froth issued from the mouth: the man appeared to be alive, but not sensible. An attempt was made to resuscitate him by the aid of the warm-bath and other means, but these failed, probably owing to the water which had penetrated the substance of the lungs. The appearances met with in the body were somewhat peculiar. The lungs were fully distended, but there was no bloody mucus or water in the air-tubes. In the windpipe and left bronchial tube, portions of the contents of the stomach were found (pieces of cabbage, &c.): the heart was perfectly empty (see *ante*, p. 628); the stomach contained a quantity of food half-digested, but no water. The medical witness attributed death to apoplexy, followed by an attack of vomiting, a portion of the food having been drawn into the windpipe by an effort to breathe. The floating was probably owing to the average specific gravity of the man's body not being greater than that of sea-water. The bodies of females have been often found floating on the surface of ponds or rivers within a few hours of the period at which death by drowning must have occurred. Mr. Procter, of York, informs me, that a woman who was seen on the banks of a river at half-past eleven in the evening, was found drowned at eight o'clock the following morning. The body was floating on the water with the face downwards. In December 1853 another case occurred, within my own knowledge. A factory-girl fell into a river while walking along the bank in the evening: the body was found floating on the surface of the water the following morning. In December 1857 an accident occurred at Whitehaven, in which a female was drowned: the body floated immediately after death. In December 1864 I was consulted by Mr. Aspinall, of Hassingden, in the following case. The dead body of a married woman was found floating on the surface of a pond, about three or four feet deep, not far from her house. She had been missed from her bed a few hours, and had on only her nightdress. The body was floating with the head and abdomen downwards, the head and legs depending. There was no *post-mortem* examination. Owing to the floating of the body, and the mental condition of the husband, it was supposed that he had first murdered his wife and had then thrown her dead body into the water. There was nothing but the floating of his wife's body to support this hypothesis, and this readily admitted of another explanation. The deceased was a small-boned woman, with a fair amount of fatty deposit about her. There were no stakes or projections in the pond by which the body could be supported, and the buoyancy could not be referred to the clothes. The specific gravity of her body could have differed but little from that of water; and as she was found floating with her mouth downwards, the air in the lungs had been probably retained, and was sufficient to support the trunk. There had been no struggling: there was no sand, mud, or weeds in her hands. She had made no effort to save herself, and had probably deliberately destroyed herself by placing her head at once under water.

It may be laid down as a general rule, that the recently *dead* body unclothed is, when left to itself, *heavier* than water, and sinks when immersed. The expulsion of air from the lungs and their penetration by water, combined with the fact that the bones and all the soft parts, excepting the fat, are of greater specific gravity than water, offer a sufficient explanation of the sinking. After a variable period, generally not more than a few days, the body will rise again to the surface, and float. The period of its rising will depend—1st, on the specific gravity of the body; 2ndly, on the nature of the water, whether salt or fresh; 3rdly, on the access of heat and air in facilitating putrefaction. If the gases generated find an escape, the body will sink: more gases may form, and then it will again rise, so that the sinking and rising may become alternate phenomena. (See page 81.) A small quantity of air collected in the abdomen, as a result of putrefaction, will suffice for the floating of the body. Thus, taking the specific gravity of the dead body at 1·08 to 1·1, it would require but little air to keep it at or near the surface of the water. But a dead body, whether death has been caused by drowning or not, may not sink at all owing to some one of the counteracting causes above mentioned.

Marks of violence on the drowned.—The chief enquiry with regard to marks of violence on the bodies of the drowned is, whether they have resulted from accident or design. In forming an opinion, a witness must give due value to the accidents to which a body floating loosely in water may be exposed. Ecchymoses of considerable extent are sometimes seen on the drowned, when the bodies have been carried by a current against mechanical obstacles in a navigable river or canal. If the deceased fell from a considerable height into water, his body in falling may have struck against a rock or projection, and have produced extensive marks of violence. Dead bodies taken out of wells often present considerable marks of violence of a vital character when the deceased persons have fallen in accidentally, or have thrown themselves in intentionally. The presence of these marks must not create a hasty suspicion of murder. It is manifestly impossible to lay down any specific rules for forming a decision in cases of this kind, since, probably, no two instances will be met with which will be perfectly similar in the details. In clearing up these doubtful points, everything must depend on the tact and acumen of the practitioner who is called upon to conduct an investigation. The first question which he has to determine is, whether the injuries on the body were produced before or after death. (See WOUNDS, *ante*, p. 384.) If after death, then they ought to be obviously of accidental origin. Accidental violence may sometimes be of a serious nature, so serious that a practitioner might well doubt whether it did not indicate that the deceased had been violently treated prior to submersion. If a dead body were taken out of water, with one or both limbs dislocated, or the vertebræ of the neck fractured, and a surgeon was asked whether such injuries could be accidental and coincident with or consequent on drowning, the answer would probably be in the negative. But an instance has occurred in which both arms were accidentally dislocated at the shoulders in the act of drowning: I allude to the case of a man who jumped from the parapet of Old London Bridge into the Thames. This exploit, it appears, he had previously performed with impunity, but on the last occasion he sank and was drowned. Both his arms were found dislocated at the shoulder-joints, in consequence, it is presumed, of his having fallen with them in the horizontal position, instead of placing them closely to his sides. The concussion of the arms on falling into the water had sufficed to produce the accident. (‘Smith's For. Med.’ p. 228.) Here, then, we have a proof that even the mechanical resistance offered by water alone may give rise to marks of violent injury on the person. Effusion of blood from this cause may take place into the cavities of the head, chest, or abdomen. Dr. N. Chevers has informed me that he assisted in examining the body of a sailor who fell into water with his head downwards; and it was found on inspection that there was an extravasation of blood in the head beneath the arachnoïd membrane, which there was every reason to believe had been produced by the fall.

It has been elsewhere observed, with respect to superficial marks of violence, that bruises or contusions are not always visible on the bodies of the drowned when they are first removed from water (p. 80). The great point with regard to all marks of violence on the drowned, is to throw light upon the questions—1st, whether drowning was really the cause of death; and 2ndly, whether, if so, the act was the result of accident, suicide, or homicide. This last question does not concern a medical witness so much as a jury, who will determine it from the facts, medical and general, proved before them.

There is one case, of rare occurrence, in which a practitioner would be apt to be misled by trusting to appearances found on the drowned. If a dead body were removed from water with a deep ecchymosed circle round the neck, evidently produced by a cord or ligature, but no traces of which could be found, it is not improbable that a suspicion would be at once raised that deceased had been murdered by strangulation, and the body afterwards thrown into water. An accident occurred some years since in which a gentleman and his wife were thrown into the water by the overturning of a small boat. The lady was drowned. On an examination of her body a livid circle was found round her neck, as if she had been strangled, but no ligature to account for it. She had evidently died by drowning, and the mark on the neck had been produced by the string of a cloak which she wore at the time of the accident. In her struggles to reach the boat, it is presumed that the tide had drifted the cloak in an opposite direction, and had thus produced the usual appearance of violent strangulation. It is not improbable that the constriction produced accelerated death. Barzellotti mentions the case of a man who was drowned in the Po while being escorted along the banks of the river, as a prisoner, by a party of soldiers. The man attempted to escape, and was drowned. Besides the ordinary appearances of drowning, there was a deep livid circle, extending completely round his neck, and immediately below this, another mark but paler in colour. The skin over the windpipe was ecchymosed. It was at first alleged that the deceased had been strangled by the soldiers, and his body thrown into the water; but from the appearance of the marks, and other circumstances, Barzellotti gave it as his opinion that they had been produced by the collar of a coarse linen-shirt which had been tightly buttoned around the deceased's neck: the collar had contracted from the imbibition of water, and had thus caused the appearance of strangulation, like any other ligature. ('Questioni di Medicina Legale,' vol. 1, p. 329. For another case, see Henke's 'Zeitschrift,' 1840, vol. 1, p. 126, Erg. H.) The following case was communicated to me as having occurred during the heavy floods in the winter of 1839. A man was carried away and drowned in attempting to ford a swollen stream. When the body was found it had been so placed by the current, that the fore-part of the neck was locked against the stump of a tree, giving rise to an ecchymosed patch like that which is sometimes produced by manual strangulation. [For the report of another case, in which there was much violence to the neck, see Henke's 'Zeitschrift,' 1842, vol. 1, p. 258, Erg. H.]

It might be said, that in cases of this description circumstantial evidence would commonly show how the mark had originated. In admitting the truth of this observation we must remember that circumstances, as matters of proof, do not always present themselves to our notice, or occur to our judgment, at the precise time that the law stands most in need of them. While, then, we use great caution in drawing an inference when there are such strong grounds for suspicion, we should not neglect to examine carefully the most trivial appearances. In a remarkable case of murder, in which the body of the deceased was discovered in a millstream, there was only one slight ecchymosed depression in the fore-part of the neck, as if from a finger. The surgeon suspected from this, that the deceased had been strangled by the pressure of a hand on the neck. The marks of drowning in the body were wanting, and the medical suspicion of the real cause of death was afterwards confirmed by the confession of the criminal. Incised wounds may be found on the body which are quite irreconcilable with any theory of accident. (Case of *Reg.* v. *Upton*, Leicester Summer Assizes, 1864.)

Accidental fractures in the drowned.—Fractures are not often met with in the drowned as the result of accident. Certain fractures likely to be followed by immediate death may forbid the supposition of their having occurred after drowning, and a careful examination of the body may show that they were not likely to have arisen from accident at or about the time of submersion. This point was raised in *Reg.* v. *Kettleband* (Nottingham Winter Assizes, 1843), where the prisoner was charged with the murder of his son, a boy aged ten years. The deceased was found dead in a pond soon after he had been seen healthy and well. An inquest was held, and as usual no inspection of the body was required by the coroner, and the jury were directed to return a verdict of 'found drowned.' An inspection was, however, subsequently made. The neck was observed to be very loose, and on further examination the toothlike process of the second vertebra of the neck was found to be separated from the first (the atlas), and the ligaments were ruptured! The three medical witnesses who gave evidence at the trial, deposed that this displacement had caused death by compressing the spinal marrow, that the injury had occurred during life, that it was not likely to have been caused by accident from a fall into the water, as there was no mark of a bruise about the head, and the pond was proved to be small, with a soft muddy bottom. All agreed that such an injury was not likely to have arisen from a blow or a fall under any circumstances, because it required for its production that the body should be fixed, and the head forcibly rotated on the trunk. It was in itself sufficient to account for immediate death, and it could not occur by accident after death from any other cause. Hence it was inferred,—1st, that death could not have been caused by drowning; 2ndly, that it had resulted from the compression of the spinal marrow by displacement of the second vertebra; and 3rdly, that this injury must have been intentionally produced by some person prior to submersion. Circumstances fixed the crime on the prisoner, and the jury returned a verdict of manslaughter, although the nature of the injury, admitting that it was not the result of accident, proved that the prisoner must have acted with a most cool and deliberate intention to destroy life. This case furnishes a serious commentary on the practice of some coroners, in denying the necessity for an inspection, and in directing what is called an open verdict of '*found drowned*,' when a body is taken out of water!

It is an important medico-legal question, whether fractures of the *vertebræ of the neck* can occur from accident alone, at or about the time of drowning. In the above case, the medical witnesses had probably good reasons for denying that the injury was accidental, although such an opinion cannot always be safely expressed merely from the absence of marks of violence on the head. In August 1858 a gentleman, in jumping from a bathing-machine head-foremost into water more shallow than he had expected, caused a fracture and displacement of the cervical vertebræ, which led to death. Mr. South quotes the case of a man who threw himself into a river to bathe from a height of seven or eight feet, the water being only three feet deep. He rose to the surface, but fell back senseless. When he recovered his consciousness, the account he gave of the accident was, that he felt his hands touch the bottom of the river, but to save his head drew it violently back, upon which he lost all consciousness. He died in about ten hours, and on examination the skin of the back of the neck was much ecchymosed, the interspaces of the muscles were gorged, and the spinal canal was filled with blood. The body of the fifth vertebra of the neck was broken across about the middle of its depth, and the two pieces were completely separated from the lateral parts. As there was no mark of contusion or dirt on the head, Reveillon, who reports the case, believes that the fracture arose from muscular action, and not from a blow received by striking the bottom: but this is doubtful. In another instance related by Mr. South, a sailor jumped headlong into the sea to bathe, a sail being spread three feet below the surface. He immediately became motionless, and died in forty-eight hours. The fourth and fifth vertebræ of the neck were found extensively fractured, and the spinal marrow was crushed and lacerated. ('Chelius's Surgery,' Part 6, Fractures.) In this case the fracture must have resulted from contact with the water or the sail; but as the latter was freely floating, this would be a yielding medium: hence this serious injury may occur accidentally in cases in which we might not be prepared to look for it. (For an important medico-legal case, involving many questions connected with marks of violence on the drowned, see 'Ann. d'Hyg.' 1839, vol. 2, p. 195.)

Was drowning the result of homicide, suicide, or accident?—Although the question whether the act of drowning was the result of suicide or murder properly falls within the province of a jury, there are certain points in relation to it which here require to be noticed by a medical witness. In the first place, it is not to be imagined that an examination of the body will develope any differences in either of the three supposed kinds of death. So far as the phenomena of drowning are concerned, they are the same, and they are accompanied by the same appearances after death in each case. In drowning which is accidental or suicidal it is not usual, as it has already been observed, to meet with marks of violence on the person, except such as are purely of *accidental origin*, and have commonly been produced *after death*. In accidental drowning this is almost a constant rule: but if the person has fallen from any height, his body may be injured in the fall, either by projections on the banks of a river or canal, or by mere concussion on the water—allowance for either of which we must be prepared to make, according to the situation of the spot from which the person is supposed to have fallen.

It is calculated that drowning is the cause of death in nearly *one-half* of all suicides; but this of course will vary according to localities. In *suicidal* drowning we have a difficulty to encounter which we do not meet with in that which is *accidental*. A man may have attempted suicide by some other means previously to throwing himself into the water: thus then, besides the accidental violence of accidental drowning, we may meet with violence on the person evidently indicating wilful perpetration. What is the nature of this violence?—Is it to be defined?—Can it always be distinguished from that which is positively *homicidal?* The answers to these questions must depend on the circumstances proved in each case.

Drowning in shallow water.—Homicide has been sometimes presumed from the peculiar circumstances under which a body has been discovered. Thus, for instance, it has been a debated question, whether a person intent on suicide can actually drown himself in *shallow* water. This question has been long since settled in the affirmative by the occurrence of some well-authenticated cases. It appears to have been raised originally on the theoretical view, that the resolution of a suicide would fail him in such a situation, and that, having the means of escape, he would lose no time in extricating himself. It need hardly be stated that the mere immersion of the mouth in water not more than a few inches deep, will produce all the phenomena of death by drowning, with the exception that little or no water would probably be found in the stomach. Devergie mentions an instance which occurred in May 1833, where a man was found drowned in a small stream, his face towards the ground, and his head just covered by the water, which was not more than a *foot* in depth. On dissection there were all the appearances of drowning present, and a large quantity of sand and gravel was found occupying the windpipe and smaller air-tubes. (Op. cit., vol. 2, p. 332.) A case is mentioned by Dr. Smith, in which a woman committed suicide by breaking a hole in the ice of a pond, during the winter, and thrusting her head into the water, the rest of her body being out. In May 1837 a man was found dead near Mitcham in Surrey. He was discovered lying on his face in a small stream of water only six inches deep. The water was so shallow that it did not cover the deceased's body or his head. There was clear evidence that this was a case of suicidal drowning. In November 1855 a man was found drowned in a water-cistern, which at the time had in it only fourteen inches of water.

The discovery of bodies under these circumstances does not necessarily establish that the act was suicidal. It is quite possible that one or more assailants may hold a person's head in such a position sufficiently long to destroy life; but as the person might be capable of making resistance, we ought then to find some marks of violence on the body. So, again, such a position is by no means incompatible with accidental drowning; and on this it may happen that a medical practitioner will be called to express an opinion. A man in a state of deep intoxication, or when suddenly attacked by syncope, epilepsy, or apoplexy, may fall with his face in a gutter, ditch, or small pool of water; he may die in this position, not having the power to extricate himself Even marks of violence on the body must not be too hastily construed into proofs of murder. Not long since a case of this description gave rise to a trial for murder in one of our midland counties. A man was found dead with his face in some melted snow, and there were several severe contusions on his body. The evidence showed that, after a quarrel, he had left a neighbouring inn much intoxicated; and it was rendered extremely probable that he had perished accidentally on his way home. There was no reason to suppose that he had been murdered. Infants, from mere helplessness, may be drowned under similar circumstances.

Drowning from partial immersion.—There is no doubt that murder by drowning may be perpetrated without the *whole of the body* being immersed in water. A case of this kind, which was the subject of a criminal trial, was referred to me by Mr. Aldred, of Norwich, in March 1841. The case was tried at the Norwich Lent Assizes of that year (*The Queen* v. *Yaxley*), and the prisoner was convicted. It appears that the mode in which the prisoner destroyed her infant child was by immersing its head for a few minutes in a pail of water. She removed it before it was quite dead; but it soon died, with slight convulsive motions of the limbs. The case was rendered obscure by the fact that the whole of the body had evidently not been immersed; and the only conceivable means of drowning were in a small duck-pond adjoining the house, which was covered with weeds; but no weed was found in the stomach of the child, although a quantity of water was there present. In April 1854, a case occurred in London, in which a woman was charged with causing the death of a child by drowning it. The child was found dead, with its face in a basin of dirty water. The prisoner had placed the child in this position, and had then locked the door. The death of a child under these singular circumstances is, however, quite compatible with *accident*. Mr. Tubbs communicated to me the following case, which fell under his notice in April 1848. He was called to see a child, æt. 18 months, which was stated to be dying. On his arrival at the cottage he found it dead: the skin was cold, and the countenance calm and pale, with the exception of a livid discolouration in the centre of each cheek. The eyelids, as well as the mouth, were half open. The pupils were largely dilated. A frothy mucus, tinged with blood, was escaping from the mouth and nostrils. The tongue was swollen, and protruded forwards. The mother of the infant, a respectable woman, gave the following account:—She was washing in one room, while the child was in an adjoining room, the door between the rooms being kept open by a pail half full of water. She went out of the house for about two minutes, and on her return she found the child with its head downwards in the pail of water, the heels and part of the body hanging over the side of the pail. She snatched it out and tried to revive it, but without effect. There was no reason to doubt the truth of her statement, and at the inquest the jury returned a verdict of accidental death. The helplessness of an infant at this age, and the rapidity with which the insensibility of asphyxia supervenes, sufficiently account for death under these circumstances. It is, however, difficult to understand how an adult could be thus accidentally drowned. The case of Mr. *Gibbs*, a city merchant, is in this respect of some interest. In October 1864 this gentleman was found dead in a water-cistern of his house. He was partly dressed; his head was downwards in the water, and his feet rested on the edge of the cistern. It was supposed that in reaching forward to the tap, he had lost his balance and fell with his head foremost into the water, and was thus unable to extricate himself. The facts seemed to point to accident. A case occurred in London, in 1841, in which a drunken man was drowned by falling on the bank of the Surrey Canal, with his head partly in the water, while the greater part of his body lay on the bank out of the water. It was by partial immersion that the Italian boy, *Carlo Ferrari*, was destroyed many years since, by *Bishop* and *Williams*, who afterwards attempted to sell the body for the purposes of dissection. The murderers first intoxicated the deceased, and then suspended his body by the heels in a well, so that his mouth was but a few inches below the level of the water. A medical man, therefore, must not allow himself to be deceived respecting the cause of death on finding that the *whole* of the body has not been immersed, or that the clothes are not wet. In this form of murder, when the inspection is recent, the hair of the head will present the appearance of wetness, and some water, with or without weeds or other foreign matters, may be found in the ear-passages, nostrils, throat, and lungs.

Ligatures on the hands and feet.—When a drowned body is removed from water with the hands and feet bound by cords, it is usually considered that we have therein strong presumptive evidence of homicide; but numerous cases are recorded in which suicides have actually bound themselves in this manner before throwing themselves into water, probably for the express purpose of preventing any chance of their escaping death. In July 1832 the body of a full-grown man was removed from the Seine, his neck, legs, and hands being secured together by a cord furnished with slip-knots. There was no doubt that he had died by drowning, and that the act was one of deliberate suicide, the cord being so placed on his body that a person could have easily placed it on himself. In this case there was no great degree of ecchymosis produced by the cord, and it was not probable that there should have been when it was arranged by a suicide, since his object would be merely that of rendering himself helpless by securing his arms and legs. This he would doubtless accomplish without giving himself much pain. If the marks bear the evidence of violent constriction, especially on *both wrists* or on the fore-part of the neck, the presumption of murder becomes strong. In a case of this kind it would be obviously of great importance to determine whether the deceased had really died from drowning or not; since, if his death had not been caused by drowning, the fact of his body, so bound, being discovered in water would furnish the strongest possible evidence of murder. ('Ann. d'Hyg.,' 1833, vol. 1, p. 207.)

Weights attached to the body.—If a body is taken out of water with heavy weights attached to it, the question of *accident*, as in the former case, is done away with. It must be either homicide or suicide, and doubtless many would be apt to suspect that it was a case of murder. Several instances have, however, occurred in which persons have committed suicide by drowning, and heavy weights have been found attached on their feet and hands, or in or about the dress.

HANGING.

CHAPTER 52.

CAUSE OF DEATH—DEATH FROM THE SECONDARY EFFECTS—APPEARANCES AFTER DEATH—MARK OF THE CORD OR LIGATURE—UNECCHYMOSED MARKS—WAS DEATH CAUSED BY HANGING?—HANGING AFTER DEATH—SUMMARY OF MEDICAL EVIDENCE—MARKS OF VIOLENCE ON THE HANGED—WAS THE HANGING THE RESULT OF ACCIDENT, SUICIDE, OR HOMICIDE?—HOMICIDAL HANGING—THE POSITION OF THE BODY.

Cause of death. Asphyxia.—By hanging we are to understand that kind of death in which the body is wholly or partially suspended by the neck, and the constricting force is the weight of the body itself, while in strangulation the constricting force is due to some other cause. In both cases death commonly results from *asphyxia*, although this must depend in a great measure upon the position of the ligature on the neck, as well as on the degree of pressure produced. If the cord is loose, or applied to the upper part of the neck, a small quantity of air may still reach the lungs, and then the cerebral circulation may become interrupted by the compression of the great vessels of the neck. In this case apoplexy of the congestive kind is induced, and operates as the immediate cause of death. It is easy to conceive that there may be a mixed condition of asphyxia and apoplexy, and according to the observations of Professors Casper and Remer this is actually met with in a great number of instances. The following tables represent the results at which they have arrived from the examination of a large number of cases:—

	Remer.	Casper.
Apoplexy	9	9
Asphyxia	6	14
Mixed conditions	68	62
Total	83	85

It has been observed in the execution of criminals, that death takes place at different intervals of time after suspension. This difference is probably dependent on the greater or less degree of constriction produced by the ligature. If the rope should press upon the larynx or above this organ, the closure of the air-passages will not be so complete as if it pressed upon the windpipe immediately below the cricoid cartilage. A slight degree of respiration might in the former case continue for a short interval, by which the life of a person would be prolonged, while in the latter, death would be immediate. If the windpipe is in part ossified, the pressure of the ligature is less perfect, and death will then take place more slowly. It has been supposed that the immediate cause of the stoppage of respiration was a pressure produced on the nerves of the neck; but it is highly improbable that, under the circumstances in which hanging generally takes place, the cord or ligature should exert any pressure on the nerves sufficient to produce death. In the greater number of cases of suicidal hanging, which are commonly unattended with much violence, the pressure on the nerves cannot obviously exist; and in violent hanging, the projection of the fore-part of the neck must suffice to prevent these slender nervous filaments from becoming exposed to such a degree of compression as directly to impede the exercise of their functions.

There is an occasional cause of death in hanging, which appears to have been first noticed by Louis. Having remarked that in some public executions death sometimes took place rapidly, and in other cases slowly, he was led to inquire into the circumstances. He found that in the cases of rapid death, the executioner was in the habit of giving a violent rotatory motion to the body of the criminal at the moment it was turned off, whereby a displacement of the toothlike process of the second vertebra of the neck took place, so that the spinal marrow was suddenly compressed. This cause of death must be extremely rare: as a general rule it is only likely to be observed in corpulent or heavy bodies, when a long fall is given to the cord, and when much violence has been at the same time employed by the executioner. It is seldom met with in persons criminally executed;—and in cases of suicidal hanging it is so unusual, that Devergie found the ligaments between the first and second vertebræ of the neck ruptured only once in fifty-two cases. M. de la Fosse considers, from the observations which he has made on this subject, that in violent hanging the process of the second vertebra is much more likely to be fractured than to become displaced, and he found this in the case of an executed criminal. On an examination of the body, he discovered that the two first vertebræ of the neck had been completely separated from the remainder of the spinal column by the rupture of the intervertebral substance, and that they were firmly attached by their ligaments to the occipital bone. The process and body of the second vertebra were detached from the bony ring, but were still connected as usual with the first vertebra. The spinal marrow had been compressed by the fractured portions of the vertebræ. Probably further observations may show that the injury to the spine is not always of the same nature, and that fractures of the vertebræ are really more frequent than simple displacement of the toothlike process. In the meantime, we must admit that such severe injuries may occur in hanging, and that when they do occur death must be sudden. But death may proceed from mere effusion of blood on the spinal membrames (sheath), thereby giving rise to fatal compression. This is likely to happen when the head falls, or is bent suddenly backwards, so that the weight of the body is supported on the back of the neck. See a case of this kind by Mr. Campbell de Morgan (*post*, p. 667).

Rapidity of death.—Death from hanging appears to take place very rapidly, and without causing any suffering to the person. It is observed, that in those who are criminally executed there are often violent convulsions of the limbs and trunk. There is no reason, however, to believe that the individual suffers pain, any more than in the convulsions of an epileptic fit. On recovery there is an entire loss of consciousness of pain in both cases. The circulation of dark-coloured blood through the brain and spinal cord may account for these effects. Efforts to inspire are made for from one to two minutes after the closure or compression of the windpipe. The diaphragm and intercostal muscles act spasmodically, but no air enters the lungs; and it is probable that in the act of hanging, part of the air contained in the organs is convulsively expelled. When the suspension of the body has only continued a few minutes, it has often been found impossible to restore life; and indeed the period at which resuscitation may take place will vary in different subjects according to circumstances. Supposing the hanging to be unattended with violence to parts about the neck, it is possible that some persons might be resuscitated after five minutes' suspension or longer. Others, again, may not be recovered when they are cut down immediately after suspension,—a fact which depends probably on the different degrees to which asphyxia or apoplexy has extended.

Death from the secondary effects.—It by no means follows that because we have succeeded in restoring the respiratory process, a person is safe. Death often takes place by a fatal relapse at various periods after the accident. A case of this description has been published by Sir B. Brodie. A boy, æt. 17, was found hanging. When cut down he was insensible, his face livid; his lips were of a dark-purple colour, pulse not perceptible, pupils dilated and motionless. Artificial respiration was used, and in a quarter of an hour the diaphragm began to act. He breathed at irregular intervals with stertor, and with a rattling noise in the throat. The pulse became perceptible but often flagging, and the surface of the body was cold. The countenance was still livid, but the pulse and breathing improved. At the end of another hour an attempt was unsuccessfully made to take some blood from the arm, and the patient was placed in a warm bath. The breathing was stertorous through the night, and in the morning twelve ounces of blood were taken from the arm; but there was no relief. He continued insensible, and cold on the surface: there was frothing at the mouth, and he died twenty-four hours after he was cut down. The body was carefully examined. The vessels of the brain were very full of blood: this was the only morbid appearance. In another instance, a labouring man who had hanged himself, was cut down in a state of insensibility. He lay for a considerable time breathing with apoplectic stertor, but eventually recovered. ('Lectures on Pathology,' 72.) Dr. Shearman reported in the 'Lancet' (Jan. 6, 1844) a case in which a powerful athletic man, who had been committed to prison for theft, hanged himself. He was found, apparently dead, hanging by his own handkerchief. He was cut down, and seen by Dr. S. half-an-hour after the occurrence. The man was then apparently lifeless; he neither breathed nor moved, nor had any perceptible circulation. The face and neck were much swollen and livid, and the ecchymosed mark of the cord was immediately below the thyroid cartilage: the fingers were bent, and the hands nearly clenched. His head was raised; the windows were thrown open, and blood was abstracted from the arm which was put into hot water in order to increase the flow. In a few minutes the man began to breathe: the bleeding was allowed to continue until the pulse was felt at the wrist, and the pupils contracted completely on the application of a lighted candle. The breathing was stertorous. A mixture of brandy-and-water was injected into the stomach, and warmth was applied to the extremities. In the course of a few hours he rallied; his pulse became firmer and quicker (130), but his head was hot; he was restless, unmanageable, and violently convulsed in the arms and legs. Shortly before death he was calm, and spoke several times: he suddenly became exhausted, and died nineteen hours after he was found hanging. This was probably a mixed case of asphyxia and congestive apoplexy. The medical treatment appears to have been proper. The unsuccessful result may perhaps be ascribed to the injury sustained by the cerebral circulation from constriction of the neck. In hanging as well as in drowning, therefore, a person may in the first instance recover, but subsequently die in spite of the best medical treatment, probably from the depressing effects produced on the nervous and muscular systems by the circulation of dark-coloured blood. A case in illustration of this point has been reported by Dr. B. W. Richardson ('Med. Times and Gaz.,' Dec. 17, 1853, p. 639). A man died on the second day after he was cut down. On inspection, the brain was found greatly congested, and there was effusion of serum under the arachnoïd membrane. The lungs and heart were congested, and a solid fibrinous deposit was found in the right ventricle.

Treatment.—Exposure to a fresh current of air, cold affusion when the skin is warm, with the vapour of ammonia and other stimuli, may be employed on these occasions. If there should be much cerebral congestion on recovery, bleeding may be resorted to. The application of electricity or electro-magnetism in the course of the spine might be attended with benefit; but much will depend as in drowning, upon the time at which assistance is rendered after the body has been cut down. The following case of recovery—in which, however, asphyxia was not complete—was reported in the 'Lancet,' Nov. 1839. A robust woman, aged thirty-three, hanged herself while slightly intoxicated. She was missed about ten minutes before she was found suspended to a bedstead, but how long she had been thus hanging it was impossible to determine. Medical assistance was rendered to her in about ten minutes after she had been cut down. She was then quite insensible,—her respiration slow and laborious, and her pulse barely perceptible. The countenance was pale,—there was no lividity; the lower jaw was depressed, the extremities were moderately warm, and the hands convulsively clenched; the pupils were somewhat dilated, and barely susceptible of the stimulus of light. A dusky-red mark, of a quarter of an inch in breadth, was distinctly observed encircling the upper part of the neck, forming an angle over the ramus of the jaw on the right side, where the knot of the ligature (a silk handkerchief) had rested; and in consequence of this the constriction was incomplete. The patient was twice copiously bled; mustard-poultices were applied to the calves of the legs, hot water to the feet, and cold applications to the head. After thirty-two ounces of blood had been abstracted, in half-an-hour the breathing became stertorous, the pupils fully dilated, the lower jaw fell further, the sphincters became relaxed, and the patient appeared to be rapidly sinking. Ammoniacal liniment was rubbed on the chest, and the woman so far recovered in an hour as to be able to swallow: but although she was conscious of pain, she remained comatose until the evening, when she became perfectly sensible of surrounding objects. This was evidently a case of imperfect suspension, where, from respiration still continuing, there was every hope of recovery. The cerebral circulation had here become simply disordered.

In a case, which occurred to Mr. Noyce, *cold affusion* speedily resuscitated the person. A man had been hanging about two or three minutes when he was cut down, and in four or five minutes afterwards he was seen by Mr. Noyce. He had then ceased to breathe: his features were pallid, and the eyes injected with blood. The heart's action continued, although feebly; the pulse being about 80, and very weak. Artificial respiration was tried without any benefit, when affusion of cold water was resorted to. This, after a short time, led to the complete establishment of respiration: at each affusion there was a deep inspiration. The man was bled to sixteen ounces, and he soon recovered his consciousness. ('Med. Gaz.,' vol. 37, p. 75.)

When great cerebral congestion is produced by a close constriction of the throat, copious bleeding will generally be found beneficial. Dr. Chevers mentions a case in which some Thugs, quite unintentionally, saved the life of a person whom they had strangled by cutting his throat. A man travelling through Tirhoot fell in with a gang of Thugs, who strangled him. He became unconscious: on recovering his senses he found that his throat had been cut, and that a fellow-traveller lay strangled to death by his side. The wound in the throat was properly treated, and the man recovered in six weeks. He was able to give a description of the gang, which subsequently led to the apprehension of four, who were sentenced to death. As Dr. Chevers remarks, it can scarcely be doubted that the violent measure of cutting the man's throat, effectually relieved the vessels of the brain of any undue congestion which the throttling may have produced. ('Med. Jur. for India,' p. 405).

These cases bear out the views long since published by Sir B. Brodie—namely, that after respiration has ceased, the heart continues to act, and to circulate dark-coloured blood, for a period of three or four minutes, to the brain and other parts of the system. The exact period of time will, however, depend on the strength of the person. It is on this ground that in hanging there is great hope of restoring a person by artificial respiration. The action of the heart was observed in one case of criminal hanging to continue for so long a period as *nine minutes and a half* after suspension. A criminal was executed for murder at Albany, U.S. The execution took place in a passage of the prison, so that the feet of the criminal were only twelve inches from the ground. The pulse was felt by a surgeon on each side. It is stated that in the fifth minute there were one hundred and twenty-eight pulsations. ('Med. Times and Gazette,' July 1, 1854.) In the after-treatment it is advisable that blood should be only sparingly abstracted, to relieve any cerebral congestion, because the vital powers are much reduced under the circumstances. Convulsions, and even paralysis, have been observed to precede recovery in experiments on animals.

Period at which death takes place.—We learn from those who have been resuscitated, as well as from experiments performed by persons upon themselves, that the insensibility of asphyxia comes on in the most insidious manner in death from hanging, and that a slight constriction of the windpipe will speedily produce loss of consciousness and muscular power. ('Devergie,' 2, 370.) The only symptoms of which the hanged persons have been conscious, were a ringing in the ears, a flash of light before the eyes, then darkness and oblivion. The only profitable inference, in a medico-legal view, which can be drawn from observations of this kind is, that asphyxia is not only rapidly induced, but that it supervenes under circumstances where it would not be generally expected to occur—*i.e.*, when the body is in great part supported. M. Fleischmann found that a cord might be placed round his neck between the chin and os hyoides, and tightened either laterally or posteriorly without perceptibly interrupting respiration: but while the respiratory process was thus carried on, his face became red, his eyes prominent, and his head felt hot. These symptoms were followed by a sense of weight, a feeling of incipient stupefaction, and a hissing noise in the ears. On the occurrence of this last symptom, the experiment, he says, should be discontinued, or the consequences may be serious! His first experiment on himself lasted two minutes; but in the second, owing to the cord by its pressure more completely interrupting respiration, the noise in the ears appeared in *half a minute.* When the pressure was applied on the windpipe the effect was *instantaneous*, but when on the cricoid cartilage it was not immediate. If it was applied between the os hyoides and the thyroid cartilage, or on the os hyoides itself, the period during which a person could breathe was extremely short; and this result was more striking when the act of expiration was performed at the moment of applying the pressure. The death of *Scott*, the American diver, in January 1840, shows how readily asphyxia may be induced by a slight compression of the throat, even when a person might be supposed to have both the knowledge and the power to save himself. This man was in the habit of making public experiments on hanging, and had frequently before gone through them without danger; but on this occasion, it is probable that a slight shifting of the ligature from under the jawbone caused so much compression on the throat between the chin and larynx, as speedily to produce asphyxia. No attempt was made to save him until it was too late, and he was not brought to a hospital until thirty-three minutes had elapsed. He was allowed to hang *thirteen minutes*,—the spectators thinking that the deceased was only prolonging the experiment for their gratification! The very insidious and painless manner in which a person who is suspended passes from life to death, is also well illustrated in the report of the case of *Hornshaw*, published by Dr. Chowne. ('Lancet,' April 17, 1847, p. 404.) This man was on three occasions resuscitated from hanging,—a feat which, like Scott, he had performed in London for public gratification. He stated that he lost his senses almost at once; that it seemed as if he could not get his breath, and that some great weight was attached to his feet: he felt that he could not move his hands or legs to save himself, and that the power of thinking was gone. It is not improbable that many persons have thus lost their lives by privately attempting these experiments, and their cases have been wrongly set down to acts of suicide. There is reason to believe that boys have thus frequently but unintentionally destroyed themselves, from a strange principle of imitation or curiosity. The following is one among many instances of this kind. In August 1844 a boy, aged fourteen, witnessed an execution at Nottingham, and he was afterwards heard to say that he should like to know how hanging felt. On the same afternoon, he was found suspended by a cord from a tree, quite dead; and from the circumstances, there could be no doubt that he had been experimenting on the theory and practice of hanging, and that he did not intend to destroy himself. The jury returned a verdict of 'accidental hanging.'

POST-MORTEM APPEARANCES.

The *external* appearances met with in the hanged have been generally taken by medico-legal writers from those seen in the bodies of persons who have been criminally executed, or who have been violently hanged. Thus among them are the following:—Lividity and swelling of the face, especially of the lips, which appear distorted: the eyelids are swollen, and of a bluish colour; the eyes red, projecting forwards, and sometimes partially forced out of their cavities; the tongue enlarged, livid, and either compressed between the teeth or sometimes protruded: the lower jaw is retracted, and a bloody froth sometimes exists about the lips and nostrils. There is a deep and ecchymosed impression around the neck, indicating the course of the cord, the skin being occasionally excoriated; laceration of the muscles and ligaments in the hyoideal region; laceration or contusion of the larynx, or of the upper part of the windpipe. There are also, commonly, circumscribed patches of ecchymosis varying in extent, about the upper part of the body and the upper and lower limbs, with a deep livid discolouration of the hands; the fingers are generally much contracted or firmly clenched, and the hands and nails, as well as the ears are livid; the urine and fæces are sometimes involuntarily expelled at the moment of death. Such appearances will rarely be found in those cases of suicidal hanging which are likely to come before a medical practitioner. In these, the face is generally pale, and the mark on the neck is a simple depression in the skin, usually without ecchymosis, and acquiring a horny or parchment colour only after some time. Esquirol found, in one instance, that when the body was examined immediately after death, the face was not livid; but it first began to assume a violet hue in eight or ten hours. He thought that when the cord was left round the neck the face would be livid, but if removed immediately after suspension, pale. This view is not, however, borne out by observation. The tongue is not always protruded. Devergie found that there was protrusion of this organ in eleven cases out of twenty-seven. This protrusion was formerly supposed to depend upon the position of the ligature: thus it was said, when this was below the cricoid cartilage, the whole of the larynx was drawn upwards, and the tongue carried forwards with it, while when above the os hyoides the tongue was drawn backwards. The protrusion or non-protrusion of the tongue does not depend upon any mechanical effect of this kind, but simply upon congestion; for it is occasionally met with thus protruding in cases of drowning and suffocation. Besides, the protrusion has not been found to have any direct relation to the position of the ligature.

There is another appearance on which a remark may be made—namely, the state of the hands. As a general rule, in violent hanging or strangulation the hands are clenched. This appearance may not always be found, as it may exist and be destroyed before the body undergoes medical inspection. When the constriction of the neck is produced suddenly, and with great violence, we may expect to meet with it. Thus it is found in the cases of executed criminals, and in strangulation attended with great violence (see case by Mr. Rake, *post*, p. 671), whether the act be due to homicide or suicide. In cases in which the constriction is gradually produced, the clenched state of the hands may not be found. (Cases by Mr. Becke, *post*, p. 672.) Convulsions generally attend violent hanging or strangulation. The influence of these on the attitude or dress may not be apparent, unless the body be sitting or lying.

Internally, we meet with the appearances described under the head of asphyxia—*i.e.*, engorgement of the lungs and venous system generally with dark-coloured fluid blood: the lungs otherwise present no particular appearances. The right side of the heart, and the great vessels connected with it, are commonly distended with blood. But when the inspection has been delayed for several days, this distension may not be observed. The mucous membrane of the windpipe is more or less congested, and is sometimes covered with a fine bloody mucous froth. This may be owing to imperfectly obstructed respiration, and to spasmodic efforts at breathing. The vessels of the brain are commonly found congested; and in some rare instances, it is said extravasation of blood has been met with on the membranes or in the substance of the organ. Effusion of blood is, however, so rare, that Remer found this appearance described only once among one hundred and one cases; and in one hundred and six cases recorded by Casper it was not found in a single instance. In one case of death from hanging, Sir B. Brodie found a large effusion of blood in the substance of the brain, and he refers to another case in which there was a considerable effusion between the membranes. ('Lectures on Pathology,' p. 58.) The venous congestion of the cerebral vessels is, however, rarely greater than in other cases of asphyxia, and is probably dependent on the degree in which the lungs have become engorged. In most instances there is increased redness of the substance of the brain, so that, on making a section of the hemispheres, a greater number of bloody points (puncta cruenta) than usual will appear (p. 532). The kidneys have been found much congested. A more important circumstance has been noticed by Dr. Yelloly—namely, that in examining the stomachs of five criminals who have been hanged, he found great congestion in all, while there was blood coagulated upon the mucous membrane in two. Such an appearance might, it is obvious, be attributed in a suspicious case to the action of some irritant substance. (See 'Ann. d'Hyg.,' 1830, p. 166; 1835, p. 208; 1838, p. 471.) In the case of *Good*, who was executed for murder some years since, the stomach was found on inspection to present over its whole surface a well-marked redness, resembling the effect produced by an irritant poison. The redness was especially observed at the pyloric end, where it assumed a somewhat striated character. A drawing representing the appearance of the interior of the stomach is preserved in the Museum Collection of Guy's Hospital. In a case examined by Mr. Stuart, of Azimghur, in 1854, the stomach and intestines, especially the inner coat of the former, were much congested and inflamed, as if the man had died from poisoning. The contents of the stomach were analysed, but no poison found. Dr. Chevers, who quotes this case, states that he has more than once verified Dr. Yelloly's observation, and has found the mucous membrane of the stomach much congested in death from hanging. ('Medical Jurisprudence for India,' p. 397.)

Mark of the cord or ligature.—The most striking external appearance, however, is the *mark* produced on the neck by the ligature. The skin is commonly depressed, and sometimes ecchymosed, but rarely throughout its whole extent: it is frequently free from all traces of discolouration as the result of ecchymosis, the skin in the depression being then hard, brown, or of a *parchment colour* and consistency; or there may be only a thin line of blue or livid colour in the upper or lower border of the depression, and chiefly in front. The course of the mark is generally oblique, being lower in the fore-part than behind, and it is often interrupted. If the noose should happen to be in front the mark may be circular, the jaw preventing the ligature from rising upwards in the same degree before, as it commonly does behind. The mark is generally single, but we may meet with it double, as when the ligature has been formed into two circles or loops previously to its application. Its other characters will depend upon the nature of the ligature employed. Thus a large and wide ligature rarely produces ecchymosis,—the mark is wide and superficial; but a small ligature produces a narrow and deep impression, sometimes accompanied with laceration of the cuticle and effusion beneath the skin. From the statistical returns of Devergie and Casper, it would appear that a cord or rope was employed in more than one-half of all the cases of hanging which they collected: in other instances various articles of dress were found to have been employed.

Medical jurists have considered it proper to inquire into the position of the cord or ligature, as this may sometimes form a question in cases of suspected murder by hanging. The following table will show that in more than two-thirds of all cases of *suicidal* hanging, the ligature is found encircling the neck between the chin and os hyoides:—

	Remer.	Devergie.	Casper.
Above the larynx	38	20	59
On the larynx	7	7	9
Below the larynx	2	1	0
	47	28	68

The ligature or cord should always be examined for blood, hair, or other suspicious substances.

Unecchymosed marks or depressions.—It was formerly believed that the impression produced by the cord was invariably discoloured from effusion of blood or ecchymosed; but more correct observation has shown that this condition is an exception to the general rule. When ecchymosis does exist, it is commonly superficial and of slight extent. There is rarely, if ever, effusion of blood in the cellular tissue. Dr. Riecke, of Stuttgard, in his observations on hanging, found only once in thirty cases an effusion of blood beneath and on both sides of the depression produced by the ligature. The tongue was generally between the teeth, and in most cases wounded by them. He attributed death to stretching of the spinal marrow. (Henke's 'Zeitschrift,' 1840, 27 Erg. H. 332.) In the bodies of persons who have been criminally executed it is not unusual to find ecchymosis, but even here it is not always present. In a case which I had an opportunity of examining some years since, there was only a slight trace of ecchymosis in one spot where the knot in the cord had produced contusion. That it should occur in criminal executions is not surprising considering the violence employed on these occasions, but it has been somewhat too hastily assumed that these appearances in executed criminals are met with in all cases of death from hanging. Dr. Croker King, in examining the neck of an executed criminal, did not discover the smallest effusion of blood in the course of the cord, although in this case the body had been allowed to fall from a height of seven feet and a half, with a fearful jerk. ('Dublin Quarterly Journal,' No. 35, Aug. 1854, p. 86; and 'Cases of Ruptured Intestine,' 1855, p. 12.) The theory of the production of ecchymosis has been carried so far, that a *livid mark* in the course of the cord has been pronounced to be the best criterion for distinguishing hanging in the living from hanging in the dead body! It will be seen, however, that no reliance can be placed on this statement. In fifteen cases examined by M. Klein, in twelve examined by M. Esquirol, and in twenty-five cases of suicidal hanging which occurred to M. Devergie (Op. cit. vol. 2, p. 394), there was no ecchymosis whatever in the course of the ligature. ('Annales d'Hyg.' 1832, p. 413; 1842, p. 146.) Out of six cases Fleichmann met with only one instance. In three cases of suicidal hanging which I have had an opportunity of examining, no ecchymosis had been produced by the ligature. In all these instances the skin, instead of being blue or livid, or presenting an effusion of blood in the cellular tissue beneath, was hard and of a yellow colour, resembling parchment. It had that appearance which the cutis commonly assumes when the cuticle has been removed from it two or three days; and, on dissecting it off, the cellular membrane beneath often appears condensed and of a silvery whiteness. Dr. Chevers states that in cases of death from hanging he has not met with any ecchymosis in the skin along the course of the mark. (Op. cit. p. 406.) In some instances the mark, instead of being livid or brown, has presented itself simply as a white depression. This has been chiefly observed in fat subjects. The observations of Casper on this point are as follows:—out of seventy-one cases there was no ecchymosis produced by the cord in fifty, and thus in two-thirds of all the cases examined it was entirely absent. He also found that there was no difference in the appearance whether the ligature was removed sooner or later after death. Remer, on the other hand, considers ecchymosis or a livid mark in the course of the cord to be a frequent appearance in hanging, but Devergie properly objects to the inference which he has drawn from the facts quoted. (Op. cit. vol. 2, p. 397.)

The following singular case, which occurred to Dr. Hinze of Waldenburg, will show that the presence of lividity or ecchymosis in the mark does not depend, as Esquirol supposed, on the ligature being left around the neck. A young man, in a fit of drunkenness, hanged himself with a stout cord. In about half-an-hour afterwards he was cut down, and attempts were made to resuscitate him. It was perceived that the cord had merely produced a superficial impression on the neck, destitute of any appearance of ecchymosis. Signs of returning life began to manifest themselves: the attempts at resuscitation were continued for several hours, but all signs of vital reaction disappeared; and now, when life was about to become again extinct, to the astonishment of those present, the mark on the neck, which had been hitherto colourless, became deeply ecchymosed. On an inspection being made the next day it was found that this ecchymosis continued, and that it was owing to a real subcutaneous effusion. From the appearances in the head, it was concluded that the deceased had died from congestive apoplexy. The late Prof. Casper regards the mark produced by the cord in hanging as a cadaveric appearance, and that it may become livid or dark-coloured after death just as lividity appears in the dead body during the act of cooling. ('Klinische Novellen,' 1863, p. 493.) This is probably the explanation of the observation above made by Dr. Hinze, but at the same time the remark cannot apply to those cases in which, as by a blow, the small vessels in the skin are ruptured from a sudden fall—the rope acting by the weight of the body. In such a case ecchymosis, arising from the effusion of blood in the course of the cord, must depend on the same causes as ecchymosis from blows in the living body.

Injuries to the muscles and deep-seated parts of the neck are, of course, only likely to be seen when considerable violence has been used in hanging. In one or two instances the lining membrane of the common carotid artery has been found lacerated. Congestion and swelling of the genital organs in both sexes have been set down among the common consequences of hanging,—but many observers have not met with these conditions; and it is doubtful whether, unless the body is examined speedily after suspension, any marked difference would be discovered. A more common sign, perhaps, is the discharge of the spermatic secretion in the male, by a spasmodic action, at the moment at which death takes place. It appears to me that no reliance can be placed upon evidence derivable from this appearance, and yet it has sufficed to give rise to a most violent controversy among French medical jurists. ('Ann. d'Hyg.' 1839, vol. 1, pp. 169, 467; vol. 2, p. 393; 1840, vol. 2, p. 314.) It is, I think, clear that unless death from hanging is strongly established by other facts, neither the examination of the linen of the deceased, nor the application of the microscope to the mucous fluid found in the urethra, would be of any practical value in elucidating the question,—at least to the satisfaction of an English jury. M. Donné justly considers evidence of this kind to be a piece of scientific refinement, in which, by attempting to prove too much, we prove nothing. Spermatic fluid may be found in the urethra of a person who has died suddenly, from accident or from natural causes; and Donné has ascertained that the discharge of a portion of this fluid into the urethra may even take place in a body hanged after death. He has found the fluid in some of these cases to contain living spermatozoa. ('Cours de Microscopie,' p. 303.) For some remarks on the relative frequency of these appearances by M. Brierre de Boismont, see 'Med. Gaz.' vol. 44, p. 84. The case of *Durville* is of interest in reference to this question. (See 'Ann. d'Hyg.' 1855, vol. 1, p. 445; and vol. 2, p. 133.)

The following may be regarded as a summary of the appearances in hanging, when death has really taken place from asphyxia. The countenance is either livid or pale, the eyes are prominent, the tongue congested and occasionally protruded, the lower jaw retracted:—the skin is covered with patches of cadaveric lividity, the hands are livid and clenched,—an oblique mark is found on the neck,—sometimes presenting traces of ecchymosis: commonly, however, the skin is only brown in colour and hardened. The larynx, windpipe, and subjacent muscles are lacerated, depressed, or discoloured. The vessels of the brain are congested, as well as those of the lungs, and the right cavities of the heart. A mucous froth tinged with blood is occasionally found in the windpipe. These appearances will of course be modified, or they may be altogether absent, when death has arisen from a disorder of the cerebral circulation, or from injury to the spinal marrow, either by effusion of blood, fracture, or displacement.

WAS DEATH CAUSED BY HANGING?

When a person is found dead and his body is suspended, it may be a question whether death really took place from hanging or not. In investigating a case of this kind, it is necessary to draw a distinction between the *external* and *internal* appearances of the body. The former alone can assist us in returning an answer to this question: the internal appearances of the body can furnish only the general signs of asphyxia, and enable us to say whether any latent cause of death existed or not. The microscopical examination of the blood, as contained in the vessels above and below the seat of constriction, has failed to throw any light upon this question. (See 'Medical Gazette,' vol. 38, p. 1042.) Neither the state of the countenance or skin, nor the position of the tongue, can afford any evidence on the subject of death from hanging.

The mark of the cord.—Among the external appearances it is chiefly to the *mark* produced by the cord on the neck that medical jurists have looked for the determination of this question. As the form, position, and other characteristics of this mark have been already described (p. 656), it will now be necessary to allude to it only as furnishing evidence of life at the time of its production. It has been stated, that so far from being constantly livid or ecchymosed, this condition is, in reality, not seen in more than one-half of the cases which occur. But admitting that we find ecchymosis in the course of the ligature, are we always to infer that it must have been applied while the person was living? The case which occurred to Dr. Hinze (p. 658) proves that the presence of active life is not necessary for the production of an ecchymosis in the mark: and from the experiments of Devergie, it would appear that if a body is hanged immediately or a short time *after death*, an ecchymosed mark may be produced on the neck by the ligature. (Op. cit. vol. 2, p. 408.) If a few hours were suffered to elapse, so that the body had become cold before suspension, no ecchymosis was produced by the ligature. Professor Vrolik of Amsterdam found, however, that a slightly livid mark was produced on the neck of a dead body, which had been suspended after the lapse of *an hour* from the time of death. (Casper, 'Woch.' Feb. 1838.) Hence this condition of the mark in a body found dead merely indicates, either that the deceased must have been hanged while living, or very soon after the breath had left his body. It would be for a jury to decide between these two assumptions; and to consider why, when a man had really died from any other cause, his body should have been hanged in secrecy immediately after death. (See 'Ann. d'Hyg.' 1842, vol. 1, p. 134.) The circumstance that an ecchymosed mark may be produced by suspending a recently dead body bears out the statement of Merzdorff—that it would be in the highest degree difficult, if not utterly impossible, to determine medically, from an inspection, whether a man had been hanged while living, or whether he had been first suffocated, and his body suspended immediately after death. In making this admission it is proper to bear in mind, that that which is difficult to a conscientious medical jurist in confining himself to the medical facts, is often easily decided by a jury from these as well as the general evidence afforded to them.

Sometimes, besides ecchymosis, there are abrasions of the skin in the course of the cord, and these are known to have been produced during life by the effusion of blood which accompanies them. Devergie never met with this appearance in the dead body even when the hanging took place immediately after death. The discovery of effused coagula in or about the spinal column would render it probable that the deceased must have been hanged while living. Such marks of violence are, however, rare in cases of hanging: and when they are found, it might be assumed that the effusion and coagulation of blood had been caused by violence offered to the neck *immediately after death*; but this assumption may be met by the question already suggested—namely, why death by hanging should be simulated in the body of a person who is alleged to have died from another cause!

With regard to the other, or more common kind of mark in suicidal hanging, it can scarcely be said to furnish any evidence in relation to the question which we are here considering. The depression may be hard and brown, although it does not usually acquire this colour until some hours have elapsed after death; for it appears to depend simply upon a desiccation or drying of that portion of the skin which has been compressed by the ligature. Sometimes the upper and lower borders only of the depression present a faint line of redness or lividity; and it is worthy of remark, that when the ligature presents any knots or irregularities, those portions of skin which sustain the greatest compression are white, while those which are uncompressed are found more or less ecchymosed. It is in this manner that the form of a ligature is sometimes accurately brought out. It may be remarked of these depressions produced by the cord, that the characters which they present are the same whether the hanging has taken place during life or soon after death: —the appearances may be similar in the two cases.

Effects of hanging on the dead body.—The following are the results of some experiments performed by Casper:—1. The body of a man, aged twenty-eight, was suspended, *an hour* after death, by a double cord passed round the neck above the larynx. It was cut down and examined twenty-four hours afterwards. Between the larynx and os hyoides there were two parallel depressions, about a quarter of an inch deep, the skin having a brown colour with a slight tinge of blue, and a leathery consistency; in certain parts it was slightly excoriated. There was no effusion of blood beneath, but the muscles which had undergone compression were of a dark-purple colour, and the blood-vessels of the neck were congested. The appearance of this body was such, that any person unacquainted with the facts would have supposed, on looking at it, that the hanging had really taken place during life;—there was nothing to indicate that the body had been hanged an hour after death.—2. The body of another young man was hanged an hour after death, and an examination was made the following day. The two depressions produced by the double cord were of a yellowish-brown colour, without ecchymosis: the skin appeared as if it had been burnt, and felt like parchment.—3. The body of an old man, who had died from dropsy, was hanged *two hours* after death. The impressions presented exactly the same characters as in the preceding case. ('Wochenschrift für die G. H.' January 1837.) When the hanging took place at a later period than an hour after death, there was no particular effect produced. In some experiments performed within a recent period, Casper found that the appearances of the neck in a corpse hanged seventy-two hours after death, could not be distinguished from that presented by the body of a person who had committed suicide by hanging. ('Klinische Novellen,' 1863, p. 489.)

We learn from these experiments, as well as from those performed by other observers, that the mark which is usually seen on the neck in hanging during life (non-ecchymosed), may be also produced, by a ligature applied to the neck of a subject *within two hours* or even a much longer period after death,—consequently the presence of this mark on the neck is no criterion whether the hanging took place during life or after death. The changes in the skin beneath the mark are also destitute of any distinctive characters: there is the same condensation of the cellular membrane whether the hanging has occurred in the living or dead. These changes are the simple result of a physical cause,—mechanical compression.

Summary of medical evidence.—From the foregoing considerations, we draw the conclusion that there is no distinctive sign by which the hanging of a *living* person can be determined from an inspection of the dead body. All the external marks may be simulated in a *dead* body, and the internal appearances furnish no characteristic evidence whatever. Still, when the greater number of the signs enumerated are present, and there is no other satisfactory cause to account for death, we have strong reason to presume that the deceased has died from hanging. We must not, however, abandon medical evidence on these occasions, merely because plausible objections may be taken to isolated portions of it. Facts may show that, however valid such objections may be in the abstract, they are wholly inapplicable in the concrete, *i.e.* to the particular case under investigation. Perhaps the greatest medical difficulties occur in reference to cases of *suicide*, owing to the slight appearances which attend this form of death; but on these occasions moral and circumstantial proofs are so generally forthcoming, that a medical inspection of the body is scarcely ever deemed necessary by a coroner. If, then, it is admitted by a medical jurist, that it is not in all cases possible to distinguish hanging in the living from hanging in the dead, the admission must be considered as having reference to cases wherein persons destroy themselves, and not to cases in which they are destroyed by others. Even if a doubt were raised in any particular instance, it is more than probable that circumstantial evidence would furnish data for a decision, and thus satisfactorily make up for the want of strict medico-legal proofs. If when we found a deeply ecchymosed or livid mark around the neck of a dead subject, we said, all other circumstances being equal, that the person had most probably died by hanging, we should not be departing from a proper discharge of our duty; since, although it is medically possible that such a mark may, by a certain amount of skill, be produced after death, yet, as it would be only a murderer who would think of hanging up a recently dead body to simulate suicide, so it is certain that in such a case there would be some obvious indications of another kind of violent death about the person. The absence of these, and the presence of ecchymosis in the course of the cord, would, it appears to me, leave the question of hanging during life decidedly settled in the affirmative. Some caution should be used in expressing an opinion that hanging took place after death, in cases in which there is no ecchymosis in the seat of the ligature; because, while such an opinion would be generally correct, it might in some instances lead to the concealment of the real mode of death. Many facts already adduced show that numerous cases of hanging during life would be pronounced to be cases of hanging after death if the absence of ecchymosis were taken as a criterion. The mere discovery of marks of violence about the person is not of itself sufficient to rebut the presumption of death from hanging on these occasions. The violence should at least be of such a nature as to account for the immediate destruction of life, or it can throw no light upon the question whether the person might not have died from hanging, in spite of the marks of maltreatment found upon the body.

If, in reference to a body found hanging, a medical jurist should assert that death had *not* taken place from this cause, this would be tantamount to declaring that the deceased must have been murdered—because it is difficult to suppose that any but a murderer would have any motive for hanging up a recently dead person. This hanging after death has been frequently carried out with the view of concealing the real mode of death, and of making the act appear to be one of suicide. The following case is reported by Deveaux:— A female was found suspended to a beam in a barn. Owing to the absence of the usual marks of hanging about the face and neck of the deceased, a careful examination of the body was made. In the course of the inspection, a small penetrating wound, evidently inflicted by a round instrument, was discovered on the right side of the chest, but in great part concealed by the breast on that side. On tracing the wound, it was found to pass between the fifth and sixth ribs, completely perforating the heart from the right to the left side. A considerable effusion of blood had taken place internally, which had been the cause of death. It was therefore evident, from the result of this inspection, that deceased had been killed, and her body suspended after death. (For a similar case by Prof. Vrolik, see Casper, 'Woch.' Feb. 1838.) Foderé refers to a case in which a person was found hanging under somewhat similar circumstances, and on examination it was discovered that death had been caused by the administration of poison,—the body having been subsequently suspended. In one instance Devergie discovered a quantity of plaster of Paris in the stomach and intestines of a person found hanging. There are, however, cases of this kind in which some embarrassment may occasionally arise. It may be a question whether the discovery of poison in the body of a person found hanging is consistent with a previous attempt at suicide by poison. A person has even been known to hang himself after or about the time that he had swallowed a strong dose of prussic acid.

Marks of violence on the hanged.—The presence of marks of violence on the body of a hanged person is important, and it will therefore be proper for a witness to notice accurately their situation, extent, and direction. Having satisfied himself that they must have been received during life, he will have to consider the probability of their being of accidental origin or not. These marks of violence are not always to be regarded as furnishing unequivocal proofs of murder; for it is possible that they may have been produced by the person himself before hanging, and not succeeding in committing suicide by these attempts, he may subsequently have resolved to accomplish his purpose by suspending himself. Let the witness duly reflect on these circumstances before he allows his opinion to implicate any suspected individual,—let him consider that a hanged subject may bear the marks of a gunshot wound, his throat may be cut, his person lacerated or disfigured, and yet, before a suspicion of homicide is allowed to be entertained, it ought to be clearly shown that such injuries could not, by any probability, have been self-inflicted. The importance of observing caution in such a case will be still more manifest when there is no ecchymosis produced by the cord, and the face does not present the usual characters of hanging.

Marks of violence on a hanged subject may in some cases be fairly ascribed to *accident.* If the person has precipitated himself with any violence from a chair or table in a furnished apartment, he may have fallen against articles of furniture, and thus have caused lacerations and bruises, especially on the limbs or body. The rope may have given way, and the person, in falling, have injured himself; but he may afterwards have had resolution enough to suspend himself again. Such an occurrence may be rare; but when the presence of these injuries is made to form the chief ground of accusation against another person, their possibly accidental origin ought not to be lost sight of by a considerate witness. If we suppose the deceased to have been hanged in a state of intoxication or stupefaction, medical evidence alone will rarely suffice to determine the question of homicide or suicide. The absence of all marks of violence from the body might actually lull suspicion. It is proper on these occasions to look to the hands of the deceased, since it is with these that a person defends himself; and, unless taken unawares, it is almost certain, if the hanging were homicidal, that there would be traces of violence on these parts. The clothes would be torn and discomposed, and the whole appearance of the deceased would be that of one who had done his utmost to resist a violent murderous attack. There might be some injuries which could not be attributed to accident under the circumstances. Among these we may enumerate fractures, dislocations, deeply penetrating incised and gunshot wounds. Now the question is—Do these serious injuries necessarily establish homicide? The answer must be in the negative: although when fractures or dislocations exist, there are strong grounds for suspicion. ('Ann. d'Hyg.' 1842, vol. 1, p. 160.)

Suicides, it must be remembered, are capable of making many attempts on their lives by various means. In the spring of 1836, a gentleman was found dead, hanging in his bedroom at an inn. His dress was much disordered; and some blood, which had issued from a deep wound in the throat, was found scattered over the floor. From the facts proved there was no doubt that this had been an act of suicide, and that the deceased, previously to hanging himself, had first attempted to cut his throat. Had his body been found in an exposed situation, this wound in the throat might have given rise to a suspicion of murder. A young man was found hanging in his bedroom, quite dead. He was suspended by his cravat, and his feet were within an inch of the floor. The door of the room was fastened on the inside, and it was proved that no one could have had access to it. An earthern pan was found near the bed, containing about a pint of blood, which appeared to have issued from a deep incision in the bend of the left arm of the deceased. The razor with which this had been inflicted was found on the mantelpiece. It came out in evidence, that on the previous night the deceased had swallowed a quantity of arsenic, and had suffered severely from the effects of the poison, although at the time it was supposed that his illness was due to other causes. In this case there were three modes by which suicide had been attempted. The deceased had first taken poison, then wounded, and afterwards hanged himself. There could be no doubt that death was caused by hanging; and had the wound been inflicted and the poison administered by other parties, this opinion of the cause of death might have been safely expressed. Had the body been found hanging in a suspicious locality, the circumstances might have created a strong presumption of murder.

The following case is reported by M. Dégranges:—A man was found hanging in a room by a cord attached to a nail in the ceiling. In the upper and fore-part of his neck there was a deep wound, through which the cord had passed. A ladder was placed against the wall by the side of the body. About a pound of coagulated blood was found on the floor, as well as in different parts of the apartment, and some linen covered with blood was discovered near the body. In a table-drawer, in the apartment above, was found some cord sprinkled with blood, as if a bloody hand had been searching in it. On the staircase between the two apartments there was no trace of blood. The deceased's apartment was secured on the inside by the door being bolted. An opinion was demanded of M. Dégranges respecting the manner in which deceased had died, and the probability of his having been murdered. The deceased's clothes were spotted with blood, and his hands were also bloody. The body externally did not present the slightest trace of any ecchymosis or other mark of violence. The hands were likewise free from violence, the fingers contracted, and the nails blue. There were patches of cadaveric lividity scattered over the trunk, and it was evident that the fæces had been discharged. The face had a slight violet tint, and the tongue, which had been forcibly compressed by the teeth, projected about an inch from the mouth. The wound in the throat was situated between the chin and os hyoides (bone of the tongue), and extended from the angle of the jaw on one side to the opposite angle. It had penetrated through the mouth to the back of the throat, but had divided only some small branches of the thyroideal artery: it had evidently been inflicted after several attempts, for its edges were irregularly cut. The cord, in passing through the wound, had lacerated and extended it at the two extremities. The vessels of the brain were filled with blood; the vertebræ of the neck were uninjured, and the stomach was free from any trace of poison. The opinion given from these data was to the effect that the deceased had died from hanging, and that he had hanged himself.

When we consider that in this case the deceased had laid open his throat, as far as the spine, dividing the right superior thyroideal artery, by which so much blood had been lost that it was not unlikely he would have soon fallen into a state of syncope, it is remarkable that he should still have had sufficient presence of mind and muscular power to have done what the evidence shows he *must* have done—namely, to have placed a handkerchief on his wound, in order to arrest the bleeding; to have gone upstairs to another room, and have searched in a table-drawer for the cord with which he intended to hang himself; to have placed a ladder against a wall, and to have made use of this for the purpose of fixing a cord to a nail in the ceiling—an act which could only be performed with great difficulty. When we duly reflect on all these circumstances, it does not appear extraordinary that the magistrate who ordered the examination, should have been prepared to receive an account of the deceased having been murdered. Much, it is true, rested upon the moral and circumstantial proofs: as, for example, on the previous state of mind of the deceased, and the fact of his room having been found secured on the inside. Casper mentions a case in which a woman was found hanging in her room. On examining the body, two penetrating wounds were seen on the left side of the chest: these had perforated the pericardium, and touched the surface of the heart, without entering its cavities. There was a basin of bloody water and a bloody sponge on the table; the right hand of deceased was stained with dried blood, and the door and window were fastened on the inside. There was no doubt that this was a case of suicide, and that after inflicting the wounds the deceased had suspended herself. The mark on the neck was nowhere ecchymosed, but of a yellowish or parchment colour. There was nothing in the nature of the wound to have prevented self-suspension. ('Ger. Leich.-Oeffn.' vol. 2, p. 89. See also 'Ann. d'Hyg.' 1848, vol. 1, p. 444.)

The remarks made relative to incised wounds will apply to gunshot wounds. A suicide may attempt to destroy himself with a pistol: he may fail in the attempt, and ultimately hang himself. Any description of gunshot wound, provided it be such as to allow of a person surviving a sufficient time, may thus be found on a hanged subject, and yet constitute no proof whatever of homicide. If there are circumstances about the wound or injury which prove that it could not have been self-inflicted, this of course will affect the conclusion; but when such circumstances are not met with, a cautious medical jurist should say, in answer to inquiries respecting the origin of these wounds, that they may have been inflicted either by the individual himself or by *another*. There might be no medical facts which would directly establish either view. In one instance of suicidal hanging there were lacerated wounds upon the head, and a handkerchief was found blocking up the mouth. (Henke's 'Zeitschrift,' 1838, vol. 2, p. 257; 1839, vol. 1, p. 207; also 1840, vol. 1, p. 135; also 'Brit. and For. Med. Rev.' No. 24, p. 560.) Of course if, in any case, the wounds or injuries are of a decidedly mortal nature, and have probably caused death, the presumption of murder amounts almost to positive certainty; for who but a murderer would suspend the dead body of a person so wounded, *immediately* after death? ('Ann. d'Hyg.' 1835, vol. 2, p. 410.)

Was the hanging the result of accident, homicide, or suicide?—Most medical jurists have passed over the subject of *accidental hanging*, probably believing it to be impossible. In the sense commonly implied by the term it is certainly unusual, but although rare, it is a possible occurrence. Dr. Smith mentions a case in which a girl of the age of thirteen years was hanged by pure accident. She was swinging in a brewhouse, and near the rope used by her for that purpose was another for drawing up slaughtered sheep. In the course of the exercise, her head got through a noose of this second cord, which pulled her out of the swing, and kept her suspended at a considerable height until dead. The following case was communicated to me by one of my pupils. In December 1833 an inquest was held on the body of a boy aged ten years. It appeared in evidence that he had been playing with a child eight years old, who was the only witness of his death. The deceased had been amusing himself in swinging, by fastening a piece of plaid-gown to a loop in a cord, which was suspended from a beam in the room. In the act of swinging he raised himself up and gave himself a turn, when the loop of rope suddenly caught him under the chin, and suspended him until life was entirely extinct. The boy who was in the room with him did not give any alarm for some time, thinking that the deceased was at play. The jury returned a verdict of 'accidentally hanged.' Another case occurred in London in 1836. A man who was in the habit of exercising himself in gymnastics on the rope, was one morning found dead and suspended in his bedroom. The rope had passed twice round his body and once round his neck, whereby it had caused death, although the legs of the deceased were resting on the floor. There was no doubt that deceased had been accidentally hanged. These are two among several instances which have come to my knowledge, and it will be seen that the circumstances under which they occurred were sufficiently decisive of the manner in which the hanging took place. Indeed, circumstantial evidence must always suffice for the discrimination of accidental hanging; and we have therefore merely to inquire whether, when the body of a person is found hanging under circumstances which do not allow of the suspicion of accident, the act has been the result of *suicide* or of *homicide*. A medical witness must remember that this is strictly a question for the jury. It is not for him to say whether a man has hanged himself or been hanged by others, but merely to state, when required, those *medical circumstances* which support or rebut one or the other presumption. The jury, under the direction of the judge, will arrive at a conclusion from the whole of the evidence.

Homicidal hanging.—It has been truly observed, that of all the forms of committing murder, hanging is one of the most difficult, and it is therefore but seldom resorted to. In most cases when a person has been hanged by others, it has been after death, in order to avert a suspicion of homicide. Hence the discovery of a person hanging affords *primâ facie* evidence of suicide, supposing it to be rendered absolutely certain that death has taken place from this cause. We must, however, admit that a man may be murdered by hanging, and that the appearances about his body will not afford the smallest evidence of the fact. The circumstances which will justify a medical jurist in making this admission are the following:—First, when the person hanged is feeble, and the assailant a strong healthy man. Thus a child, a youth, a female, or a person at any period of life, worn out and exhausted by disease or infirmity, may be destroyed by hanging. Secondly, when the person hanged, although usually strong and vigorous, is at the time in a state of intoxication, stupefied by narcotics, or exhausted by his attempts to defend himself. Thirdly, in all cases murder may be committed by hanging when many are combined against one person. With these exceptions, then, a practitioner will be correct in deciding, in a suspected case, in favour of the presumption of suicide. Unless the person laboured under stupefaction, intoxication, or great bodily weakness, we must expect to find, in homicidal hanging, marks of violence about the body; for there are few who would allow themselves to be murdered without offering some resistance—notwithstanding the assertion of Mahon, that some might submit to this mode of death with philosophical resignation when they saw that resistance was hopeless! The following singular case of attempted murder by hanging is mentioned in 'Symes's Justiciary Reports' (Edinburgh, 1827). A woman, aged sixty-nine, was charged with attempting to hang her husband, who was some years older. It appeared that the accused contrived to twist a small rope three times round the neck of her husband, while he was lying asleep. She then tied him up to a beam in the room, in such a manner that when the neighbours entered he was found lying at length on the floor, with his head raised about one foot above it. He was quite insensible; his hands were lying powerless by his side, his face was livid, and it was some time before he could be roused. Had he remained three minutes longer in this position, he would have died. According to his statement, he went to bed quite sober, and he was not aware of anything which had passed during the attempt to hang him, or afterwards, until he was resuscitated. The prisoner was convicted of the assault without previous malice, she having had no ill-will against her husband, and being herself at the time intoxicated. It can hardly be considered possible that any man should be so sound asleep as not to be awakened by the attempt thus made to hang him. The probability is that the prosecutor was, like his wife, completely intoxicated and helpless. A case of alleged murder by hanging, and of considerable difficulty in its medical relations, was tried at the Exeter Summer Assizes, 1851. (*Reg.* v. *Rowe.*) Although the prisoner was acquitted, there were some strong facts leading to the belief that this could not have been an act of suicide.

Some medical jurists have thought that the *mark* left by the cord on the neck would serve as a criterion of murder on which we might depend. Thus it has been said, if the mark is circular and situated at the lower part of the neck it is an unequivocal proof of murder. In hanging, the mark of the cord is generally oblique, being higher at the back part of the neck, in consequence of the loop formed by it yielding more in this direction than in front. But it is an error to suppose that this want of obliquity in the impression can afford any evidence in favour of the act having been homicidal. Its form will depend in a great degree upon the fact of the body being supported or not, for it is the weight of the body which causes its obliquity; it will also depend on the manner in which the cord is adjusted. A case of suicidal hanging is related by Orfila, in which the mark of the cord extended horizontally round the neck from behind forwards. ('Méd. Lég.' tom. 2, p. 376.) The slip-knot of the cord was in front of the neck, and it is obvious that when the cord is thus adjusted by a suicide, there will be scarcely any obliquity in the depression produced by it. Equally ill-founded is the assertion, that the existence of *two impressions* on the neck affords positive proof of homicide. One of these impressions may be at the lower part of the neck, and circular—the other at the upper part and oblique: it is therefore contended, that the deceased must have been strangled in the first instance, and afterwards hanged. The possibility of a prior attempt being made by a suicide to strangle himself, and thus produce the mark, is not adverted to. 'Si l'on observe les deux impressions,' says Mahon, 'l'assassinat est alors parfaitement prouvé.' It is fortunate that there are facts on record to oppose to this very positive statement. One of the first cases reported by Esquirol is that of a female lunatic who committed suicide by hanging herself, and on whose neck two distinct impressions were seen—the one circular, the other oblique! These appear to have arisen from the cord having been passed twice round the neck, the body being at the same time partially supported. In some instances a presumption of homicidal interference may exist if there are two distinct impressions, but it cannot be admitted that they establish the fact of murder.

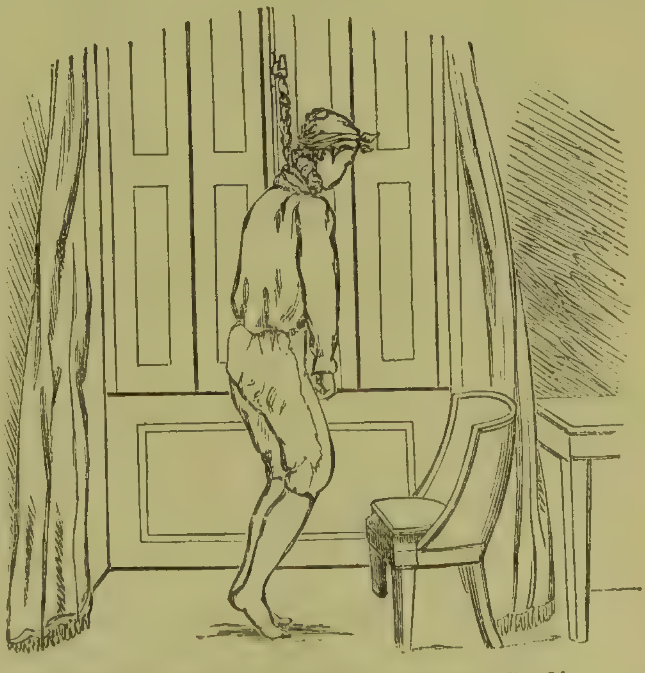
The injury done to the neck by the cord or ligature can rarely afford any clue to the manner in which hanging took place, unless the circumstances under which the body is found, favour the presumption of homicide or suicide. Thus the laceration of the muscles and vessels of the neck, the rupture of the windpipe and the displacement of the larynx, the stretching of the ligaments of the spine, and effusion on the sheath of the spinal marrow, may be observed in suicidal as in homicidal hanging. The presumption, however, is obviously in favour of the latter, when these violent injuries are found to be accompanied by fracture or displacement of the vertebræ of the neck, and the body of the deceased is not corpulent, the ligature by which he is suspended is not of a nature to produce them, and the fall of the body has not been great. As a rule, a long fall in suicidal hanging is rare. Mr. Clegg, coroner for Boston, informs me that on one occasion he held an inquest in a case of suicidal hanging, in which the deceased had fixed the rope to the top of a beam of a lofty barn, and gave himself a fall of about fifteen feet. The face of the corpse had an expression of the most horrible agony, and the tongue was protruded and bitten. Had the body been examined the muscles and bones of the neck would probably have been found much injured.

Injury to the vertebræ of the neck.—A much-disputed question has arisen in medical jurisprudence, whether the vertebræ of the neck can become fractured or displaced in *suicidal* hanging. Most medical jurists deny the possibility of this accident occurring—the displacement or fracture of these vertebræ being rarely observed, even in criminal executions when the greatest violence has been used by the executioner. So far as I am aware, there is no case of *suicide* on record in which such an injury to the neck has been found. A case referred to by Petit, which was left to the decision of Dr. Pfeffer, is unsatisfactory, because the body was not examined; and it is doubtful whether the act was really one of suicide or not. M. Ansiaux of Liége, in inspecting the body of a woman who had hanged herself, found extravasated blood behind the two first vertebræ of the neck, which were more widely separated behind than usual. On removing the vertebræ the posterior ligament of the spine was found ruptured, and the transverse ligament of the first vertebra (atlas) so stretched that the process of the second vertebra was completely locked against the articular surface. The perpendicular and oblique ligaments were entire. The deceased was a stout healthy person; when discovered, her body was suspended from a beam at the distance of about a foot and a half from the floor. She had evidently fallen with considerable force. The case of this female will serve to show that severe injury to these deep-seated regions of the neck may be occasionally met with in suicidal hanging. A case somewhat similar to this has been reported by Mr. Campbell de Morgan. ('Lancet,' August 10, 1844.) A married woman, aged fifty, worn out and exhausted by disease, was found hanging quite lifeless from the rail of a bed, which was not more than five feet eight inches from the ground. The front of her body was turned round towards the bed, the head thrown forcibly backwards—the knot of the ligature, an old silk handkerchief, being placed in the middle of the under side of the chin. Her heels were about three inches from the ground—the knees being on a level with the bed-frame, and resting against it. The body was seen by a medical man about an hour after it was cut down. The features were perfectly calm, and there was no trace of congestion about the face: it was pale, and in all respects natural. There was no lividity; the eyes were neither injected nor prominent; the tongue was pale, lying far back in the mouth, and without any mark of indentation from the teeth. The cord-mark was well-defined, of a parchment colour, dry, brown and hard, without any ecchymosis, but with a thin line of congestion at the upper edge of the groove; it was very deep at the back of the neck, just over the first vertebra or atlas, probably owing to the head hanging backwards. The mucous membrane of the stomach was pale; the lungs natural: there was no congestion of the large veins or of the cavities of the heart,—the two ventricles contained about an equal quantity of blood. These appearances showed that death was not caused either by asphyxia or by cerebral congestion. Neither the windpipe nor the great vessels of the neck could have sustained any pressure or constriction. The deep muscles over the second and third vertebræ of the neck were ecchymosed; this ecchymosis extended to the sheath of the spinal marrow; and on the left side, and externally to the sheath, there was a large effusion of blood firmly coagulated. There was no displacement of the second or other vertebræ, and the ligaments were sound; but between the third and fourth vertebræ there was unusual mobility, as if they had been stretched. In this case the body was not heavy, and the fall, if any, could have been but trifling. The effusion on the spinal marrow was the cause of death; and its origin was sufficiently explained by the falling-back of the head and sudden bending of the vertebræ of the neck. Her husband and family were in an adjoining room, but heard no noise: it was only by accident that the deceased was discovered.

Circumstantial evidence.—In all doubtful instances we should not lose sight of moral and circumstantial evidence. We should ascertain whether the individual had been previously disposed to commit suicide or not: we should observe whether the doors and windows of the apartments had been secured on the inside or on the outside; whether the dress of the deceased is at all torn or discomposed, or his hair dishevelled; whether the attitude of the body is such as to show interference after death; whether there are marks of blood about the body, or the ligature, or in the room; whether the hands are bloody, or present marks of wounding or struggling; whether the rope or ligature corresponds to the impression seen around the neck; and lastly, whether the cord is of sufficient strength to support the weight of the deceased. (Case of *Pinckard*, *post*, p. 684.) The strongest evidence of homicide is often found in the attitude and the state of the dress of the dead body: it may or may not indicate interference or change after death irreconcilable with the supposition of death from suicide or accident. On this point the minutest circumstance may become of considerable importance as medical evidence. When there are indications of violent struggling, the dress may be found disordered, unless it has been smoothed or arranged by the murderer after the death of the deceased. (See p. 684.) There may of course be no evidence of disorder or discomposure of the dress, in the case of a female, when the body is fairly suspended. These points fall, it is true, more within the province of the officers of justice than of a medical practitioner; but the latter is generally the first who is called to see the deceased, and therefore, unless such facts were noticed by him on his visit, they might often remain altogether unknown. The medical opinion of the actual cause of death, however, must be based only on *medical* facts. But circumstantial evidence has on various occasions assisted in clearing up a doubtful case. Louis states that on removing the body of a man who was found hanging, the rope was observed to be stained with blood. This simple circumstance led to further investigation, by which it was discovered that the person had been murdered, and his body afterwards suspended. The presence of marks on the neck indicative of strangulation, such as the cord was not likely to have produced, may lead to a suspicion that the hanging followed death. In April 1829 a boy was found hanging, perfectly dead. On inspecting the body a round ecchymosed mark, about the size of a dollar, was seen on the forepart of the neck; and near it were several impressions, as of fingers and nails, in the surrounding skin. There was neither depression nor ecchymosis in the course of the cord. The inspection left no doubt that the deceased had died from asphyxia. It was subsequently discovered that the boy had been first strangled, and afterwards hanged. In another case the body of a man was found hanging in a room: it was so suspended from a hook that the trunk was not more than nine inches from the floor, and the legs were stretched out at length. The cord was from two to three feet long, and put loosely passed round the neck. The furniture of the room was in great disorder, and some marks of dried blood were seen on one part of the floor. The right side of the head and face of the deceased presented several excoriated and ecchymosed marks. There was a circular impression around the neck produced by the cord, but it was entirely free from ecchymosis. On the left side, a little above this impression, there was a strongly ecchymosed mark, which could be traced round to the back of the head. Blood was found effused beneath this mark. The lungs presented the appearances of asphyxia, but the examiners referred this to strangulation and not to hanging, considering that the body had been suspended after death in order to simulate suicide. The circumstances of the case appear to have fully justified this conclusion. (See the case of *Pinckard*, STRANGULATION, *post*, p. 684.)

The position of the body.—Lastly, it has been contended that the *position* of the dead body may serve to distinguish suicidal from homicidal hanging. This point was strenuously argued on the investigation which took place relative to the death of the *Prince de Condé* in 1830. This case has been elsewhere referred to (p. 39) in reference to the time at which death probably took place. It requires a brief notice here, as it involves two glaring errors in medical evidence on death from hanging: 1st, that a person cannot die from hanging when the body is in any way supported, and therefore that murder must have been perpetrated; 2ndly, that in all cases of death from hanging, the mark produced on the neck by the cord or ligature must be discoloured or ecchymosed. If not ecchymosed, it is assumed that death must have taken place from some other cause, and the body have been afterwards suspended for the concealment of crime. On the 27th August 1830, the *Prince de Condé* was found dead in his bedroom, partly dressed, his body being suspended from the fastening of the window-sash by means of a linen handkerchief attached to a cravat which he was in the habit of wearing. The annexed engraving (Fig. 1) will give an idea of the position in which the body was found. The head was inclined a little to the chest, the tongue was congested and protruded from the mouth: the face was livid, a mucous discharge issued from the mouth and nostrils, the hands were clenched, the toes of both feet touched the floor of the room, the heels were elevated and the knees were partly bent forward. The point of suspension was about six and a-half feet from the floor. The legs were uncovered, and had some slight abrasions upon them. There was a

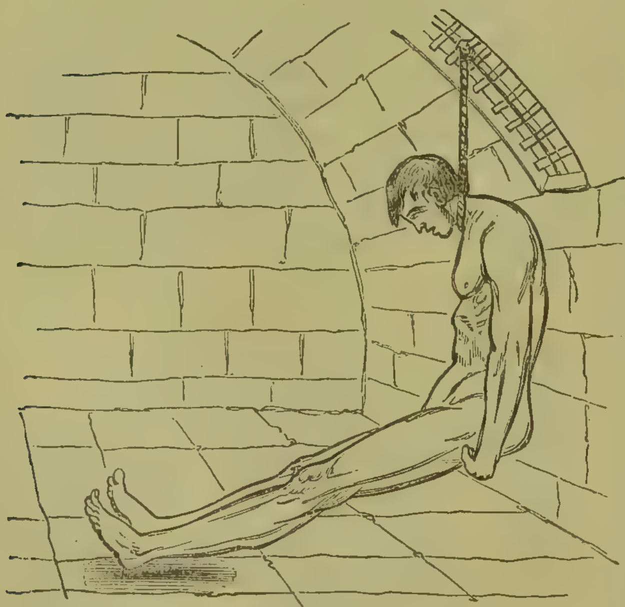
FIG. 1.



Suicidal Hanging. Case of the Prince de Condé.

chair near the deceased. Five medical men—three of them eminent experts, Drs. Marc, Marjolin, and Pasquier—inspected the body, and found the usual appearances indicative of death from asphyxia. There were no marks of violence about it beyond those which might have been produced accidentally by the chair in the act of hanging. There was no natural cause of death in the body, nor any appearance to indicate that there had been violent struggling or resistance on the part of the deceased. On the upper and lateral part of the neck there was a mark produced by the ligature, but no ecchymosis; and on the left side of the neck, corresponding to the knot of the cravat, there was a depression somewhat deeper. ('Ann. d'Hyg.' 1830, vol. 1, p. 157.) The case involves only the ordinary details of suicidal hanging; and but that the deceased was a prince, and there was much political excitement at the time, the event would have passed unnoticed. It was contended, however, that he had been strangled by assassins, and his body afterwards hanged. The characters presented by the mark on the neck, and the erect position of the body with the feet on the floor, were the chief medical points on which those who adopted the hypothesis of murder rested their case. The evidence derivable from the mark on the neck has been elsewhere considered (p. 659); and with regard to the erect position of the body, all experience is against those who would treat this as negativing suicidal hanging. If there is any medico-legal fact really ascertained respecting asphyxia, it is that, in order that death should take place from hanging, it is not necessary that the body should be freely and perfectly suspended. In his report of the above case, Dr. Marc quotes a number of instances, and gives illustrations of death under these circumstances. In one of them (Fig. 2) a man committed suicide by hanging himself in a prison-cell. He was found quite dead nearly in a sitting position, his heels resting on the floor and his body being only a foot and a half above it. Fig. 3 represents a man, æt. 40, who committed suicide by suspending himself from a hook above his bed. When found dead he was in a kneeling position —his knees being only eight or ten inches above the bed, and his toes resting upon it. ('Ann. d'Hyg.' 1830, vol. 1, p. 201.) Many cases have been since recorded in which death has taken place from hanging when the feet were in contact with the ground, or the persons were almost sitting or recumbent: they may be regarded as mixed cases of hanging and strangulation. The reports of eleven cases of suicidal hanging or strangulation which I have collected within a few years, give the following results: in three the deceased were found nearly recumbent; in four in a kneeling posture—the body being more or less supported by the legs—and in four the persons were found sitting. In one case the deceased, a prisoner, was found hanging to the iron bar of the window of his prison, which was so low that he was almost in a sitting posture. The ligature which he had employed was a cravat, but (what was more remarkable in the case)

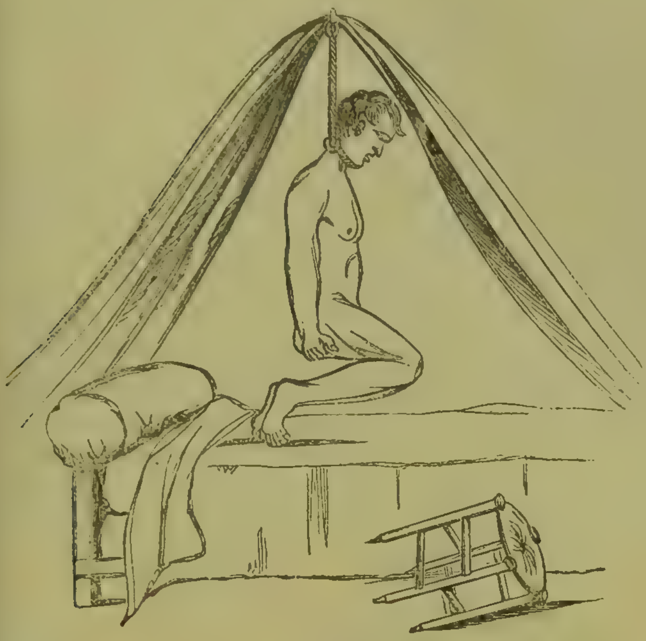
Fig. 2.



Suicidal Hanging.

the hands of the deceased were found tied by another handkerchief. The body was warm when discovered. There was not the least doubt of this having been an act of suicide; yet, as the reporter of the case observes, had the body been found in an unfrequented spot, the discovery of the hands *tied*, if not the position, would have led to a strong suspicion of murder. In the opinion of the reporter, the deceased had contrived to tie his hands together by means of his teeth. ('Ann. d'Hyg.' 1831, vol. 1, p. 196; also 'Ann. d'Hyg.' 1832, vol. 1, p. 419.) Among the cases collected by Esquirol is the following:—A patient in La Charité was found one morning hanging by a rope which was attached to the head of his bed. He had fastened this by a loop round his neck, but his body was so retained, that when discovered he was on his knees by the side of his bed. There are one or two similar instances related by the same author. Mr. Webb met with a case in which a man destroyed himself while lying at full length on a bed. His head was in a loop formed by a leathern strap fastened to the bed-post. ('Med. Times and Gaz.' Aug. 7, 1852, p. 137.) The following case fell within my own knowledge:—In 1832 a man was found hanging in his room, with his knees bent forwards, and his feet resting upon the floor. He had evidently been dead for some time, since cadaveric rigidity had already commenced. The manner in which this person had committed suicide was as follows: he had made a slip-knot with one end of his apron (he was a working mechanic), and having placed his neck in this he threw the other end of the apron over the top of the door, and shutting the door behind him he had succeeded in wedging it in firmly. At the same moment he had probably raised himself on tiptoe, and then allowed himself to fall; in this position he died. The weight of his body had already sufficed to drag down a part of the apron, for it seemed as if it had been very much stretched. The deceased was in the position in which the body of the Prince de Condé was found (p. 669), and the depression produced by the ligature on the neck was, as in that case, nowhere ecchymosed. These facts, so far from being considered to negative suicide, were treated as perfectly in accordance with it. (For another case by Dr. Albert see Henke's 'Zeitschrift,' 1843, vol. 2, p. 50.) Casper reports an instance in which a man was charged with the murder of his wife because her body was found hanging in almost an erect position! ('Ger. Leich.-Oeffn.' vol. 2, p. 92.) Mr. Rake (a former pupil) has communicated to me the particulars of a well-marked case of suicidal hanging which occurred in August 1852, in which the person was found almost in a sitting posture. A man, æt. 21, hanged himself by a silk handkerchief passed through a ring only twenty-six inches from the ground. Mr. Rake saw him in a few minutes after he had been cut down: the body was quite warm. When first seen, the man was lying with his feet extended at full length; the handkerchief was drawn tightly round the throat by a slip-knot, and his face was directed towards the ground. Both hands

FIG. 3.



Suicidal Hanging.

were firmly clenched. There was a well-defined, nearly circular, and much-indented mark round the lower part of the neck corresponding to the ligature. The ligature was drawn so tightly at one or two points, as to appear almost buried in the folds of the skin about the neck. There was much ecchymosis at various spots in the back of the neck, and some abrasion of the skin at two or three points. There was swelling, with great congestion of the face. There was no escape of blood from the ears.

Mr. Becke, coroner for Northampton, has furnished me with three additional cases, which occurred at the General Asylum for Lunatics in 1852. In the first, the man made a loop of a twisted blanket at a height of less than five feet from the ground, and then kneeling forward strangled himself, the feet being on the ground and the knees nearly touching it. The fingers were not clenched nor contracted, but partially bent. There were no marks of any convulsive struggle except a slight bruise on the wall. In the second case the man hanged himself on a beam: the legs touched the ground—the hands were not clenched. In the third, the patient had hanged himself by mounting on a shelf in a loft, fastening his neck-handkerchief to a beam, and then swinging himself off. He was found with his right leg suspended in the air, whilst his left leg was supported by the shelf on which he had been standing. His right hand was convulsively clenched, which is said to have been a habit on the part of the deceased; the left hand was open, and the fingers only slightly bent.

Remer found that out of one hundred and one cases of suicidal hanging, in fourteen the body was either standing or kneeling, and in one instance it was in a sitting posture. Dr. Duchesne has published an account of fifty-eight cases in which the suspension of the body was partial—the feet or trunk being more or less supported. Twenty-six of these cases are new. The reporter draws the conclusion that *suicide* by hanging is consistent with *any posture* of the body, even when resting upon the two feet. ('Ann. d'Hyg.' Oct. 1845, vol. 2, pp. 141 and 346.) Further evidence need not be adduced to show how unfounded is that popular opinion which would attach the idea of homicidal interference to cases in which a body is loosely suspended, or in which the feet are in contact with any support. We ought rather to consider these facts as removing a suspicion of homicide; for there are probably few murderers who would suspend their victims, either living or dead, without taking care that the suspension was not partial but complete. Besides, the facts of many of these cases are readily explicable: thus, if the ligature is formed of yielding materials, or if it is only loosely attached, it will yield to the weight of the body after death, and allow the feet to touch the floor, which they might not have done in the first instance. If there is reason to believe that the body has not altered its position after suspension, we must remember the facility with which insensibility comes on, and the rapidity with which death commonly ensues in this form of asphyxia. (See 'Med. Gaz.' vol. 44, p. 85.)

The limbs secured in suicidal hanging.—One or two points are also worthy of notice in relation to this medico-legal question. The hands or legs, but more commonly the former, have been found tied in cases of undoubted suicidal hanging ('Ann. d'Hyg.' 1832, vol. 1, p. 419); and yet it has been gravely debated whether it was possible for a person to tie or bind up his hands, and afterwards hang himself! It is unnecessary to examine the ingenious arguments which have been urged against the possibility of an act of this kind being performed; since, among many cases that might be quoted, two occurred in 1843, in this metropolis, where the persons died from hanging: the act was suicidal, and the hands were found tied, in both instances, with a silk handkerchief. A third case occurred at Worcester, in December 1844, in which the deceased tied his wrists with a silk handkerchief; and secured to this were two flat-irons, in order to increase the weight. A remarkable case of suicide, in which the hands and ankles were tightly secured, has been communicated to the 'Medical Gazette' by Mr. J. H. Taylor (vol. 45, p. 388; see also cases in 'Guy's Hospital Reports,' Oct. 1851).

Power of self-suspension.—It has been a debated question, whether *corporeal infirmity*, or some peculiarity affecting the hands, might not interfere with the power of an individual to suspend himself. This question can be decided only by reference to the special circumstances of the case. In the case of the *Prince de Condé*, it was alleged that he could not have hanged himself, in consequence of a defect in the power of one hand: it was said that he could not have made the knots in which the cravats by which he was suspended were tied. Allegations of this kind appear to have been too hastily made in this and other instances. A determined purpose will often make up for a great degree of corporeal infirmity; and unless we make full allowance for this in suicide, we shall always be exposed to error in drawing our conclusions. Blindness is no obstacle to this mode of perpetrating suicide; and in reference to *age*, suicide by hanging has been perpetrated by a boy of nine and by a man of ninety-seven years of age.

STRANGULATION.

CHAPTER 53.

CAUSE OF DEATH—APPEARANCES AFTER DEATH—WAS DEATH CAUSED BY STRANGULATION, OR WAS THE CONSTRICTION APPLIED TO THE NECK AFTER DEATH?—MARKS OF VIOLENCE—ACCIDENTAL, HOMICIDAL, AND SUICIDAL STRANGULATION.

Strangulation.—Cause of Death.—Hanging and strangulation are usually treated together, and some medical jurists have admitted no distinction in the meaning of these terms. In hanging the phenomena of asphyxia take place in consequence of the *suspension* of the body, while in strangulation asphyxia may be induced not only by the *constriction* produced by a ligature round the neck independently of suspension, but by the simple application of *pressure*, through the fingers or otherwise, on the windpipe. M. Tardieu considers that the two modes of death should be kept distinct. The external and internal appearances in some respects differ; and while the proof of death from hanging leads to the strongest presumption of suicide, the proof of death from strangulation is equally presumptive of murder. (*Sur la Strangulation*, 'Ann. d'Hyg.' 1859, vol. 1, p. 107.) This medical jurist defines 'strangulation to be an act of violence, in which constriction is applied directly to the neck, either around it or in the forepart, so as to prevent the passage of air, and thereby suddenly suspending respiration and life.' This definition obviously includes hanging, and every person who is hanged may be said to be strangled; but while there is only one method of producing death by hanging, there are various methods of producing death from strangulation. A person may be strangled by the use of a cord, band, or ligature drawn tightly round the neck, or by manual violence to the front of the neck, whereby respiration is prevented. The *cause* of death is asphyxia or apnœa. The rapidity with which it takes place will depend on the degree of pressure, and the completeness with which the act of breathing is obstructed.

M. Faure applied a ligature forcibly and suddenly to the neck of a middle-sized dog. For fifty-five seconds the animal did not appear to suffer; but he suddenly became violently agitated, his body stiffened, and he rolled convulsively on the ground. A bloody froth issued from his nostrils and throat, and he made frequent and violent efforts to respire. In three minutes and a-half he was dead. In a second experiment an elastic tube was introduced into the windpipe, which admitted of being gradually closed by pressure. The animal could bear the pressure up to the reduction of one-half of the calibre of the tube; but beyond this he suffered greatly, and when the pressure was increased he had convulsions. The dog died, in great suffering, before the tube was completely closed. ('Ann. d'Hyg.' 1859, vol. 1, p. 122.) It is probable that human beings die more quickly than animals, especially from the effects of manual strangulation. A sudden and violent compression of the windpipe renders a person powerless to call for assistance and give alarm, and it causes almost immediate insensibility and death, without convulsions. When a ligature or bandage is used the pressure is not so complete, and death takes place more slowly with convulsive movements. The circulation of dark-coloured blood continues for a short interval (about four minutes), as in other cases of asphyxia. Owing to this the face and lips, in accidental strangulation, have been observed to acquire a dark-leaden hue. This arises partly from the arrest of the current of venous blood as the result of compression of the vessels, and partly from the circulation of unaërated blood. There is a fair chance of recovery if the cause of constriction is removed, and air is permitted to have access to the lungs, within a period of five minutes: this is on the assumption that no great mechanical injury has been done to the neck.

In the act of strangulation a much greater degree of violence is commonly employed than is necessary to cause death; and hence the marks produced on the skin of the neck will be, generally speaking, much more evident than in hanging, where the mere weight of the body is the medium by which the windpipe is compressed.

POST-MORTEM APPEARANCES.

The appearances after death are similar to those of hanging, but the injury done to the parts about the neck is commonly greater. If much force has been used in producing the constriction, the windpipe, with the muscles and vessels in the forepart of the neck, may be found cut or lacerated, and the vertebræ of the neck may be fractured. The face is commonly livid and swollen, the eyes wide-open, prominent, and congested, and the pupils are dilated. The tongue is swollen, dark-coloured, and protruded; it is sometimes bitten by the teeth, and a bloody froth escapes from the mouth and nostrils. The principal *external* signs of strangulation are seen in the marks on the neck produced either by a cord or manual pressure. M. Tardieu has described another appearance which might be overlooked. This consists in the presence of numerous small spots of ecchymosis upon the skin of the face, neck, and chest, as well as in the conjunctivæ or membranes of the eyes. These parts present a dotted redness, which has, however, been met with in other cases besides death from strangulation. ('Ann. d'Hyg.' 1859, vol. 1, p. 125.)

The mark on the neck when a ligature has been used is commonly described as a depression, wide but not deep, and corresponding in its characters to the form and thickness of the ligature and the mode in which it has been secured. Too much importance must not be attached to this supposed correspondence when the ligature is not forthcoming. In the illustration given at page 680, the mark round the neck presented the appearance which might be expected from the use of a narrow cord. In this case, however, a soft silk neckerchief was the means of constriction; and the peculiar narrowness of the mark on one side, as seen in the engraving, was owing to the great tightness with which it had been drawn. The mark or impression produced by a ligature is generally circular, from the mode in which the pressure is produced. It may be situated at any part of the neck, but it is more commonly below the windpipe. In manual strangulation the marks of bruising and ecchymosis will be in the front of the neck, chiefly about the larynx and below it. The circular direction of a mark produced by the ligature is not an absolute indication that strangulation has taken place without suspension of the body, since instances have been related where a circular mark has been observed in hanging (p. 666); and it is possible that some degree of obliquity may occasionally exist in the course of the depression produced by a ligature in strangulation. A medical jurist ought, therefore, to weigh all the facts connected with the position of the body, and the nature and direction of the ligature, before he forms an opinion, from the appearances presented by the mark on the neck, whether the person has been hanged or not. Greater importance is to be attached to the lividity, ecchymosis, and abrasion of the skin in the course of the ligature, than to the circularity or obliquity of the depression produced by it. In the strangling of a living person by a cord, it is scarcely possible that a murderer can avoid producing on the neck marks of severe injury, and in the existence of these, we have evidence of the violent manner in which death has taken place. On the other hand, a person may be strangled, and yet the ligature, in consequence of its being soft and of a yielding nature, will not cause a perceptible depression or ecchymosis—scarcely anything more than a slight depression of the skin. If we except cases of suicide, such a condition must be rare; because assailants usually produce a much more violent constriction of the neck than is necessary to ensure the death of a person. The general lividity of the body, contraction of the fingers, with clenching of the hands and swelling and protrusion of the tongue, are more marked in strangulation than in hanging. A thin mucous froth tinged with blood is occasionally found in the air-passages in both cases. In some instances of strangulation, it is said, blood has escaped from one or both ears during the act; but this is not a usual appearance. In two well-marked cases, to be related hereafter (p. 684), the constriction was carried to a great degree, but there was no bleeding from the ears. Dr. Geoghegan has informed me that in one instance of *suicidal* strangulation which he examined, the constriction had been produced by a riband, and the violence applied was sufficient to produce bleeding from one ear: on dissection this was found to have resulted from a rupture of the membrane of the drum of the ear. There was no froth at the mouth or nostrils, and scarcely any lividity or swelling of the face. It was further observed that the mark on the neck, which was deep, almost disappeared on the removal of the ligature. Sir W. Wilde, of Dublin, met with a case in which rupture of the membrane of the drum of the ear, with effusion of blood, was caused by strangulation. Bleeding from the ears, as a result of rupture of the membrane of the drum, must, however, be regarded as an exceptional appearance. Dr. Chevers does not mention it as having been noticed in any one of the numerous cases which he has collected in his Indian experience, although bleeding from the nostrils had been observed. ('Med. Jur. for India,' 1856, p. 374.) Without rupture of the membrane of the drum, blood could not issue from the ears, and in order that this membrane should be ruptured, certain conditions not commonly met with may be required.

Internal appearances.—In a case which occurred to Dr. Fuller, the body of a woman who had been homicidally strangled, presented the following appearances. The skin of the head, face, neck, and chest was darker than natural, and discoloured underneath, particularly that of the scalp. The brain was suffused with dark blood, the lungs gorged and of a dark colour, the bowels of a dusky-red colour. The eyes were somewhat protruded and bloodshot, the lips swollen and darker than natural, the tongue slightly protruding between the teeth, and froth issuing from the nostrils. There was a mark of pressure behind the right ear, and other marks on the neck and chest, with discolouration of the muscles. (Chevers's 'Medical Jurisprudence for India,' p. 378; see also p. 387.) In a case of suicidal strangulation which occurred at Liverpool, in 1863, the body of the deceased was found—dead, cold, and rigid—about seven hours after he had been seen alive. The arms were flexed, and the hands raised a little above the breast. Round the neck, just below the cricoid cartilage, was a strip of the deceased's shirt which had been used as a ligature: it was tied at the *back* of the neck. There was slight ecchymosis in the mark beneath. The face had a dark-red colour dotted with spots of a deeper red. The conjunctivæ were ecchymosed, and some blood had escaped from the nose. The brain was congested, and much fluid effused. The heart was empty: the lungs were deep in colour (congested). ('Lancet,' Aug. 15, 1863, p. 183.) Many of the cases of strangulation which have presented themselves have been too superficially examined. The most complete account of the appearances is that given by M. Tardieu. It is based on observations made in twenty-eight inspections. ('Ann. d'Hyg.' 1859, vol. 1, p. 132.) The lining membrane of the larynx and windpipe was more or less reddened from congestion,—sometimes it was livid or of a dark-red colour. There was a bloody froth extending into the air-tubes. The state of the lungs was variable. Contrary to what is generally alleged to be characteristic of death by asphyxia, M. Tardieu found these organs to contain but little blood. Sometimes they were congested, at other times normal. There were ruptures of the superficial air-cells producing patches of emphysema, which were seen singly or in groups. This condition, which was rarely absent, gave to the surface of the lungs the appearance of being covered with white layers of thin false membrane. When these patches were punctured, air escaped. There was an absence of that condition of the lungs which he observed in death from simple suffocation—namely, dotted ecchymosis on the surface, immediately below the investing membrane (the pleura). Throughout the substance of the lungs, effusions of blood varying in size were, however, generally found, provided an early inspection of the body was made. When some days had elapsed the lungs were found pale or congested, without any ecchymosed or mottled appearance. The ruptured air-cells with air beneath them were still visible on the surface.

The heart presents no uniform condition: it is sometimes quite empty, and at others it contains dark fluid blood. The brain is occasionally congested, but more commonly in its natural state. In one instance blood was found effused on the brain, but this is an unusual appearance. It has also been stated that a congested state of the sexual organs both in males and females was one of the appearances connected with strangulation, but this has not been confirmed by careful observers. M. Tardieu met with nothing to call for notice in this respect in the numerous cases which he examined. The involuntary discharge of fæces, urine, and seminal fluid, described as one of the characters of death by hanging, may equally occur in death from strangulation. No importance can be attached to this as a sign of death from asphyxia in any form. It frequently occurs in sudden and violent death from any cause, and there are many instances of death from asphyxia in which it is not observed. Among the occasional appearances of violent strangulation may be mentioned injury to the windpipe and the muscles of the neck around it. One case in which the rings of the windpipe were split as a result of pressure, was communicated to me by Dr. Inman of Liverpool. Several instances of laceration and rupture of the windpipe are quoted by Dr. Chevers. (Op. cit. pp. 381, 384.) In one instance the ossified thyroid cartilage had been broken and forced inwards, causing suffocation. In *Reg.* v. *O'Brien* (Liverpool Winter Assizes, 1857), a case of alleged murder by strangulation, the cartilage of the windpipe was broken; and in the case of *Pinckard* (p. 684, *post*), the windpipe was broken longitudinally. In reference to fractures of the larynx, see Casper, 'Klinische Novellen,' 1863, p. 497. In suspected homicidal strangulation it is always proper to examine the contents of the stomach for narcotic poison. In all cases the cord or ligature, if forthcoming, should be carefully examined, in order to determine whether it bears upon it marks of blood, or whether hair or other substances are adhering to it. A portion of it should be reserved for the purposes of identity. In two instances of homicidal strangulation, the ligatures found round the dead bodies were proved to correspond with portions of the same material found in the possession of the persons who were charged with the murders. In removing the ligature from the neck, the mode in which it is secured should be noticed, as this may be a fact of importance in reference to the allegation of suicide.

The medico-legal questions relative to strangulation are of the same nature as those which have been already considered in treating of hanging. Thus, in examining the body of a person suspected to have been strangled, we may be required to answer the following question:—

Was death caused by strangulation, or *was the constricting force applied to the neck after death?*—Medical jurists have hitherto considered that the *internal* appearances throw no light upon this question. This opinion probably arose from the fact that inspections have not been made until some days after death, when the peculiar appearances of strangulation have been merged in those of putrefaction. The state of the lungs, however, may be considered as characteristic. It would be impossible by the application of a ligature round the neck of a dead body to produce rupture of the air-cells on the surface of the lungs, and effusions of blood in their substance. The state of the eyes and of the inside of the larynx and windpipe in persons who have been strangled could not be imitated by any constriction of the neck after death: no bloody mucous froth would be found in the windpipe or air-tubes.

The *external* appearances have been considered to furnish more accurate means of distinction. Although the condition of the neck generally yields the strongest evidence, it will be proper to seek for that appearance of dotted redness or ecchymosis in the skin of the face, neck, and chest, described by Tardieu. The state of the eyes, as to their prominence and the congestion of the membranes, as well as the position of the tongue, should also be examined.

The ecchymosis about the depression on the neck, when a ligature has been employed, with the accompanying swelling and lividity of the face, are phenomena not likely to be simulated in a dead body by the application of any degree of violence. When the constriction is produced within a few minutes after death, an ecchymosed depression may result; but it is improbable that there should be any lividity or swelling of the countenance. The experiments of the late Prof. Casper, referred to in the section on Hanging (p. 660), bear directly upon this question. He determined, from his observations, that when the constricting force was not applied to the neck until *six hours* after death, the mark indicative of vital strangulation could not be produced. The following is a summary of his experiments on strangulation in the dead body:—

1. *Six hours* after death a double cord was tightly drawn around the neck of a female, below the larynx. On the following morning the cord was loosened, and the neck examined: there was no particular appearance. When the skin had assumed its natural position, the part where the cord had been placed was scarcely distinguishable.—2. A man died of apoplexy, and

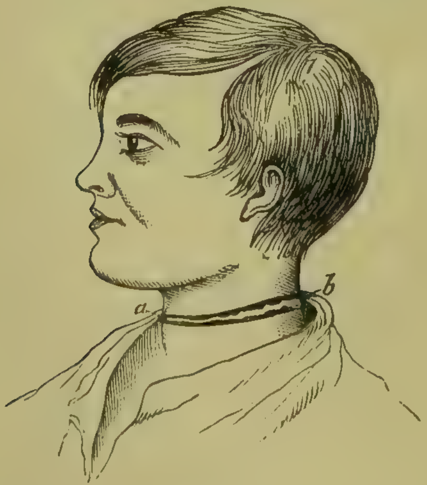
thirteen hours after death a cord was drawn as tightly as possible around the neck, above the larynx. Six hours afterwards, on examining the neck, a soft impression, easily removed by pressure, was perceptible. There was no discolouration nor any other change to be discovered in the skin.—3. *Twenty-four hours* after death a double cord was very tightly drawn around the neck of a male subject. On examination the next day, there was a slight double depression, but no colour nor any other perceptible change. This experiment was repeated on another subject, with similar results.—4. The last experiment was on the body of a child, about one year and a-half old. On the day after death a small cord was tightly drawn and secured around the neck. Twenty-four hours afterwards a slight bluish-coloured mark was perceived: it was quite superficial, but sufficiently distinct to strike the eye. On cutting into the skin there was not any blood effused beneath. We learn from these experiments, that when the attempt to simulate strangulation in a dead body is not made until *six hours* at least have elapsed, there is no risk of confounding the mark thus produced with that which is formed when the violence is applied to a living person. It is probable that, so far as *ecchymosis* is concerned, if the attempt were made after an hour or two hours had elapsed, none would be produced; and with regard to the *non-ecchymosed* mark, it is doubtful whether it could be produced after three or four hours. These periods, it must be remembered, cannot be determined with positive certainty; the results would probably vary, according to the rapidity with which the body had cooled.

It is difficult to conceive under what circumstances an attempt to simulate strangulation in a recently dead body could be made, unless for the purpose of throwing suspicion upon an innocent person connected with the deceased. When an individual has been murdered, it is not likely that the murderer would attempt to produce the appearances of strangulation on a body after death, under the idea of concealing his crime; for strangulation is in most cases an actual result of homicide, and is rarely seen as an act of suicide. In the absence of ecchymosis from the neck it will be difficult to form an opinion, unless from circumstantial evidence. It must be remembered, however, that there may not always be an ecchymosed *circle*; for a person may be strangled by the application of pressure to the windpipe through the medium of the finger-nails, or of any hard or resisting substance. The ecchymosis in such a case will be in detached *spots* or *patches*. In the absence of all marks of violence round the neck, we should be cautious in giving an opinion which may affect the life of an accused party; for it is not probable that homicidal strangulation could be accomplished without the production of some appearances of violence on the skin over the larynx or windpipe. It is doubtful whether strangulation can ever take place without some mark being found on the neck indicative of the means used. The bare possibility of death being caused in this manner, without leaving any appreciable trace of violence, must be admitted; although the admission scarcely applies to those cases which require medico-legal investigation. Suicides and murderers generally employ much more violence than is necessary for the purpose of destruction—hence detection is easy. But if a soft and elastic band were applied to the neck with a gradually regulated force, it is possible that a person might die strangled, without any external sign being discovered to indicate the manner of his death. Indian surgeons inform us that the Thugs, and other robbers met with in India, are thus accustomed to destroy their victims with the dexterity of practised murderers. A case involving this question of strangulation without marks of violence on the neck, was tried in France, and from the medical evidence decided in the affirmative. ('Gaz. Méd.' 9 Mai 1846, p. 375.) The medical witness should, however, be prepared to consider whether, in the absence of any mark, death might not have proceeded from another cause, and leave it to the authorities of the law to decide, from circumstances, in favour of or against the prisoner. There is, I conceive, nothing to justify a medical witness in stating that death has proceeded from strangulation, if there should be no appearance of lividity, ecchymosis, or other violence about the neck or face of the deceased. Congestion in the organs of generation is an appearance which it would not be safe to take as evidence of death from strangulation. The state of the countenance alone will scarcely warrant the expression of an opinion; for there are many kinds of death in which the features may become livid and distorted from causes totally unconnected with the application of external violence to the throat, unless accompanied by other well-marked signs of this mode of death. So, again, the eyes and tongue may be protruded as a result of putrefactive changes. Let not a witness, then, lend himself as an instrument for the condemnation of a person against whom nothing but a strong suspicion from circumstances may be raised, and where medical evidence is unable to furnish any distinct and conclusive proofs of death from strangulation. This caution is especially necessary in reference to the inspection of bodies which are in a state of putrefaction. A medical man, already provided with a theory of the cause of death by the discovery of a rope or other means of constriction, may easily arrive at the conclusion that death has taken place from strangulation. The absence of the usual confirmatory appearances in the body may be ascribed to decomposition, and those caused by decomposition may be set down to strangulation. When there is obvious mechanical violence to the neck, such as fracture of the larynx or windpipe, with laceration of the muscles beneath,—a visible depression, such as a cord, a ligature, or manual pressure would produce, a medical opinion may be fairly given in spite of putrefaction. But when, in a putrefied body, indistinct marks on the neck, or patches of discoloration, are relied upon as evidence of homicide, there is great risk of a serious medical mistake. See on this question the cases of *Mrs. Ellen Byrne* (Dublin, Aug. 1842, at p. 71, *ante*), and of *Reg.* v. *Mahaig* (Kingston Winter Assizes, 1863, p. 74). For an account of the appearances presented by a strangled body thirty-eight days after interment, see Henke's 'Zeitschrift der S. A.' 1842, vol. 1, p. 235; and vol. 2, p. 310.

In cases of alleged drowning, it is sometimes the practice to ask a medical witness how far his opinion of the cause of death has been influenced by the discovery of the dead body in or near water. In cases of alleged strangulation a similar question may be put in reference to the discovery of a rope or ligature round the neck of the deceased, or in the apartment in which the dead body is found. A medical opinion should rest upon the clear and obvious effects produced on the neck, and on the structures below the skin, and not upon the mere presence of a cord or ligature. This might be put round the neck of a dead body, or near to it, for a malicious purpose. The act of strangulation should be, medically speaking, as distinctly provable without the production of a rope, as the act of stabbing without the production of the knife which inflicted the stab. If these principles are not strictly adhered to in practice, policemen would be as competent as medical experts to give evidence of the cause of death in cases of alleged strangulation.

It is scarcely necessary to state that all marks of violence on the body of a supposed strangled person should be accurately noted, as the questions respecting them, however slight, are material. The witness will be expected to state whether they were inflicted before or after death: if before, whether they were sufficient to account for death, or whether they were such as to be explicable on the supposition of an accidental, suicidal, or homicidal origin. It should be observed whether there exist any morbid changes, sufficient to account for death, in either of the three great cavities of the body, as this kind of evidence may be essential in the progress of the case. In reference to females, whether children or adults, the surgeon should not neglect to examine the sexual organs—to ascertain whether there are any marks of violation. Cases have occurred in which rape has been perpetrated, and strangulation resorted to for the purpose of concealing the crime.

Was the strangulation the result of accident, suicide, or homicide?—Strangulation, like hanging, is occasionally the result of *accident*, but the occurrence may be looked upon as rare. When the body is not suspended, it is commonly more in the power of a person to assist himself, and escape from the constriction: hence accidental strangulation is less frequent than accidental hanging. A few instances of accidental strangulation are on record. One is recorded by the late Dr. Gordon Smith. The subject was a boy, who was accustomed to move about with a heavy weight suspended by a string round his neck. One day he was found dead in a chair: the weight appeared to have slipped, and to have drawn the cord tightly round the forepart of his neck. In June 1839, a girl was accidentally strangled in the following manner: she was employed in carrying fish in a basket at her back, supported by a leathern strap passing round the front of her neck, above her shoulders. She was found dead, sitting on a stone wall; the basket had slipped off, probably while she was resting, and had thus raised the strap, which had firmly compressed the windpipe. A similar case is recorded by Watson ('On Homicide'). In November 1864, I saw the following case in Guy's Hospital. A boy, æt. 14, while working in a factory was caught by a silk neck-tie in the band of an engine, and his neck was by this drawn down against one of the revolving shafts. The silk handkerchief being knotted and tightly twisted round his neck, his throat was firmly compressed for about one minute. The tie was then cut. As a result of the strangulation, he became black in the face, and blood escaped from his mouth and ears. He was insensible for six or seven minutes after the ligature had been removed. He then revived and was able to speak, but could not hold up his head. When brought to the hospital soon afterwards, he was sensible: his face was pale, his lips were livid, his eyes suffused, and the conjunctivæ injected. He breathed without difficulty, and only complained of pain when he moved his head. There was a deep circular depression round his neck over the windpipe, and the skin was much lacerated and bruised. The mark *a b*, in the annexed engraving, was about three-quarters of an inch in width on the side represented. The circumference of the neck was twelve inches, while the inner circumference of the handkerchief, which compressed the neck, was only eight inches. From this difference it will be perceived that the neck sustained a very strong compression, which accounts for the flow of blood from the mouth and ears.



The boy informed me that at the time of the accident he felt no pain: he had a sense of choking, and then became insensible. For at least *one minute* no air reached the lungs. He recovered, and left the hospital in about eighteen days. The facts of this case confirm the observations of Casper and others on the rapidity with which insensibility comes on from compression of the windpipe.

As a general rule, cases of accidental strangulation present no difficulty to a medical jurist, provided the relations of the body to surrounding objects and the compressing force have not been disturbed. Should it happen, however, that the body has been removed from the place in which it was first discovered, or the ligature taken from the neck, we can only establish a presumption of accident from the description given.

When a charge of murder is instituted against a person, an attempt is not unfrequently made by counsel for the defence, to show the probability that the deceased might have fallen while in a state of intoxication, and have become accidentally strangled, either by a tight cravat or by some foreign substance exerting pressure on the windpipe. If we admit the possibility of an occurrence of this nature, we must not lose sight of the existence of other more probable modes of death, nor should we allow our judgment to be so swayed as to abandon what is probable for that which is merely possible.

Suicidal strangulation.—This mode of suicide must be regarded as of extremely rare occurrence, and, except under particular circumstances, impossible. The possibility of an individual strangling himself was for a long time denied by medical jurists; for it was presumed that when the force was applied by the hand, all power would be lost as soon as the compression of the windpipe commenced. This reasoning, which is physiologically correct, is, however, only applicable to those cases in which the windpipe is voluntarily compressed by the fingers. When a person determined on suicide allows the windpipe to be compressed, by leaning with the whole weight of his body on a cord passed round his neck and attached to a fixed point, he may perish in this manner almost as readily as if he had hanged himself; for insensibility and death will soon supervene. In the chapter on Hanging, it was stated that suicides were often found with their bodies in close contact with the ground; and cases were described in which strangulation was accomplished, in the manner above described, while the suicide was in a sitting or kneeling posture (p. 670). On other occasions, the peculiar disposition or nature of the ligature has enabled a person bent on suicide to strangle himself without much difficulty. An instance is related by Orfila, in which two cravats, that were twisted several times round the neck of the deceased, who was discovered lying on his bed, had effectually served the purpose of self-destruction. ('Méd. Lég.' vol. 2, p. 389.) Sometimes strangulation has been suicidally effected by a rough cord passed repeatedly round the neck, and tightened by being pulled with each hand. The number of coils would still cause some pressure to be exerted even when the grasp was relaxed by death. (See 'Guy's Hospital Reports,' Oct. 1851.) Other cases are related, in which suicides have succeeded in strangling themselves by tightening the ligature with a stick (see case by Mr. Thorp, 'Guy's Hospital Reports,' Oct. 1851); or when the ligature was formed of thick and rough material, by simply tying it in a knot. A young female of Montevrin, in the Canton of Lagny, was found one morning dead in bed, lying on her face, with a woollen garter passed twice round her neck, and secured in front by two simple knots, strongly tied the one on the other. The body was in an incipient state of putrefaction, but still there was a mark corresponding to the ligature. This was shallow, of a slight greenish colour, especially in front, and presented here and there ecchymosed spots; posteriorly the mark was scarcely visible. The face was livid and swollen: a quantity of bloody mucus escaped from the mouth and nostrils. The lips were livid; the tongue was protruded, and firmly compressed between the teeth: the body presented over the trunk and limbs patches of ecchymosis. On cutting into the mark on the neck there was no extravasation, neither was there any apparent injury to the deep-seated muscles or adjacent parts; the lungs were gorged with blood, but the other viscera presented no particular appearance. The medical examiners gave it as their opinion that the deceased had died from apoplexy resulting from strangulation. They stated that the head was not examined, and they judged that apoplexy was the cause of death from the condition of the face. A more important question was, whether the strangulation was suicidal or homicidal. There was some reason to suspect the latter, and indeed a person was pointed out as the probable murderer; but a rigorous medical investigation, relative to the state of the body and clothes, as well as numerous collateral circumstances, satisfactorily established that this was really an act of self-destruction. ('Ann. d'Hyg.' 1829, vol. 2, p. 440: see also a case by Dr. Simeons, Henke's 'Zeitschrift,' 1843, vol. 1, p. 335.)

Sometimes the appearance of the *mark* on the neck will allow us to establish a slight presumption for or against homicide. In homicidal strangulation, from the unnecessary violence used, we may expect to find the skin much ecchymosed, lacerated, or excoriated, and the deep-seated parts, such as the muscles and vessels, as well as the windpipe itself, more or less bruised, lacerated, or extensively injured. Such a degree of violence is not commonly to be expected in *suicidal* strangulation.

Supposing the marks of fingers or finger-nails to exist, the presumption is in favour of homicide, as also in all cases where the actual cause of strangulation is not at once apparent on the discovery of the body. Suicides are not likely to strangle themselves in any other manner than by a ligature applied circularly. If the ligature be still around the neck of the deceased, the position of the knot may throw some light upon the case; if tied in two or three knots at the back of the neck, the presumption is assuredly in favour of homicide. Then, again, the nature of the ligature should be attended to. Suicides generally employ for ligatures those articles which are nearest at hand,—such as cravats, stockings, or garters. Some medical jurists have attempted to limit the varieties of suicidal strangulation; contending that when a subject is found strangled in any other way than in one of those arbitrarily laid down by them as essential to suicide, it is evidence of murder. The fact is, cases as yet are few, and each new instance of suicidal strangulation presents us with something novel in the means of its accomplishment: a sufficient proof, therefore, that we ought to be cautious how we decide these questions by hastily preconceived rules.

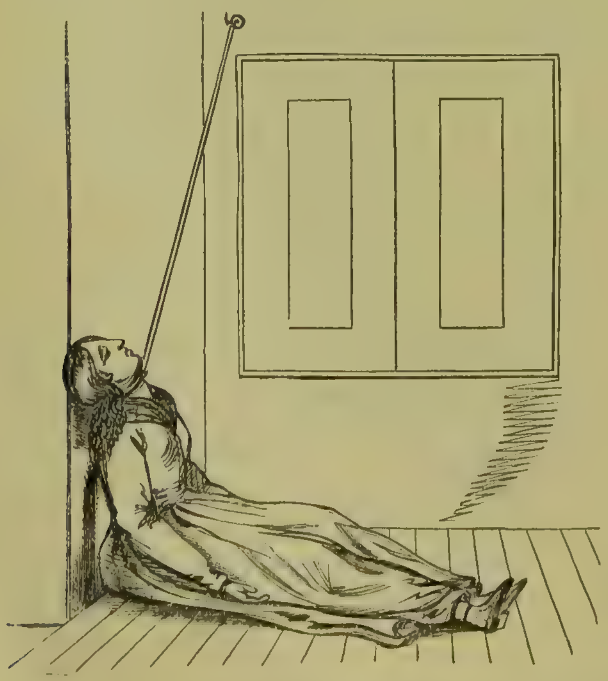
The mode in which the notorious criminal *Greenacre* attempted to destroy himself by suicidal strangulation presented some novelty; and certainly it does not fall within the methods which, according to some medical jurists, suicides ought on these occasions to adopt! In March 1837, while he was confined at a station-house, he was found by an inspector who entered the room, lying on the floor with a handkerchief drawn tightly around his neck by means of a loop, into which he had inserted his foot. When first seen his face was livid and he was apparently dead: the handkerchief was cut, and bleeding, with other means of resuscitation, was employed with success. The manner in which General Pichegru was found strangled in prison gave rise to a strong suspicion of murder, merely from the singularity of the method adopted. The ligature which he employed was found tightened around his neck by means of a stick, which had been twisted, and then fixed behind one ear: there was no lividity of the face. It was contended that Napoleon I. had caused the General to be strangled or suffocated, and that the ligature was afterwards applied. The evidence of this having been an act of homicide is very weak; and, so far as the medical circumstances extend, there is no reason to doubt that it was an act of suicide. The only obstacle to the admission of this, in the opinion of some jurists, was the employment of a stick for the purpose of tightening the ligature; but there are at least two similar cases on record, in which a suspicion of murder could not be entertained: one of these is referred to by Metzger (Op. cit. p. 309), and I have recorded another in 'Guy's Hospital Reports' for October 1851. There may be disease, such as paralysis or deformity in one or both of the arms, which may render it impossible for a person to tie a ligature around his own neck. The only caution here to be guarded against is that we do not push this doctrine of incapability too far. When there is a fixed resolution, many apparent impossibilities may be overcome by a person bent on suicide. The following case is, in this respect, instructive:—A middle-aged woman was brought into the Hôtel-Dieu, Paris, in March 1833, labouring under such a degree of mental excitement as almost to amount to insanity. Soon after her admission she destroyed herself by strangulation. The nurse, in going round the ward, saw her lying at the side of the bed with her head hanging out. Upon examination it was found that she was quite dead, and that there was a silk handkerchief around her neck. The handkerchief had been carried twice round the neck and then tied in front. The eyes and eyelids were strongly reddened and swollen. The mark of the ligature around the neck was deep, ecchymosed, and partially excoriated: the brain though a little congested was healthy. The other organs presented no appearance calling for notice. ('Ann. d'Hyg.' 1833, vol. 2, p. 153.) It is worthy of remark that in this instance, in which there could be no doubt of suicidal strangulation, the deceased had lost four fingers of her right hand, so that this member had been from an early period of but little service to her; nevertheless, she contrived to tie the cravat round her neck with great firmness and dexterity. It is easy to conceive that, had her body been found in a suspicious locality, a plausible opinion of homicidal strangulation might have been formed from the maimed condition of the hand. This case, then, will serve to convey a proper caution in drawing inferences as to what persons labouring under any corporeal infirmity are capable of doing when they make attempts on their own lives.

Although the cases just related show that suicidal strangulation may be effected under unexpected circumstances, yet in a case of murder by strangulation, it would not be easy to simulate suicide: it would at any rate require great skill and premeditated contrivance on the part of a murderer, so to dispose the body of his victim, or to place it in such a relation to surrounding objects, as to render a suspicion of suicide even probable. Thus, if the cord or ligature should be found loose or detached,—if the ecchymosis or mark in the neck should not accurately correspond to the points of greatest pressure,—if, moreover, the means of compression were not evident when the body was first discovered and before it had been removed from its situation, there would be fair grounds for presuming that the act was homicidal. In cases in which strangulation has resulted from a compression of the windpipe by the fingers, and where there are fixed ecchymosed marks indicative of direct manual violence, we have the strongest presumptive evidence of murder; for neither accident nor suicide could be urged as affording a satisfactory explanation of their presence.

Homicidal strangulation.—Strangulation occasionally comes before our Courts of law as a question of murder: and when a person has been tried upon a charge of this kind, the circumstances have been commonly so clear, as to have rendered the duty of a medical witness one of a simple nature. Difficulties, however, have occasionally arisen, as may be seen by reference to the cases of *the Queen* v. *Taylor* (York Lent Assizes, 1842), *the Queen* v. *Greek* (Salisbury Lent Assizes, 1842), *the Queen* v. *Reynolds* (Central Criminal Court, Dec. 1842), and *the Queen* v. *Fowles* (Stafford Lent Assizes, 1841). In *Reynolds'* case it was left uncertain by the medical evidence whether death was due to strangulation, or malicious exposure to cold; and as the indictment only charged the former act, the prisoners were acquitted! For a full report of a case in which the question was whether the deceased had committed suicide by hanging, or had been strangled by her husband, I must refer the reader to 'Cormack's Journal' for 1844, p. 344. The prisoner was acquitted on a verdict of 'not proven;'

but there could be no medical doubt of his guilt. A case of alleged murder by strangulation *(Commonwealth* v. *Flannagan)* will be found reported in the 'American Jour. of Med. Sciences,' Oct. 1845, p. 389.

Among important cases of murder by strangulation which have been brought to trial in this country, there are two in which I was required, on the part of the Crown, to investigate the circumstances, and give evidence respecting the mode in which death took place, as well as to assign the medical reasons which led to the inference that the deceased persons could not have died by their own hands. For a full report of one of these cases (*Reg.* v. *Drory*, Essex Lent Assizes, 1851), I must refer the reader to 'Guy's Hospital Reports,' Oct. 1851. The deceased, a female, was found lying upon her face strangled, with a rope coiled three times round the lower part of her neck: the two inner coils (involving the windpipe) being tight and the outer coil loose, the end of the cord being placed loosely near the left hand of the deceased, which was raised towards it. The length of the free portion of cord was not sufficient to allow of the deceased grasping it, and tightening it to such a degree as to produce the great amount of violence found on the neck. The windpipe was flattened and its canal completely obstructed by the pressure of the two inner coils of rope. Admitting that a person could draw one coil so tightly, he could not retain the power of drawing a second with equal force, and after this a third. Fleichmann's experiments prove that pressure on the trachea, sufficient to flatten it, is attended with instantaneous insensibility and loss of power (p. 653, also at p, 680). In *Drory's* case too much was done: one coil might have left the question of homicide doubtful—three coils, so drawn, were inconsistent with the theory of suicide. The prisoner, a man of good social position, was strenuously but, at the same time, fairly defended by able counsel; but the evidence, medical and circumstantial, clearly traced the crime to him and he was convicted. Most of the reported cases of suicidal strangulation published by writers on medical jurisprudence were read at the trial in open court, and the details compared with the evidence for the prosecution; but all admitted of a satisfactory explanation. Two medical witnesses appeared for the defence. They were called with a view of showing that the deceased might have destroyed herself; but the cases within their own experience, which they adduced to support their opinion, were so entirely different in the details, that they merely showed the possibility of suicide by strangulation, and not that suicide was possible or probable in the case under investigation.



In the other case (*Reg.* v. *Pinckard*, Northampton Lent Assizes, 1852), it was proved that deceased was found in a sitting posture in a corner of her room on the floor, with a narrow tape round her neck, hung loosely and singly over a small brass hook about three feet above her head. Her clothes were placed smoothly under her, and her hands were open and stretched out by her side. The annexed figure, taken from a plan of the room soon after the murder, will give an idea of the position of the body. There was a severe bruise over the right eye, and there were marks of blood on the tape, as well as on the floor and wall of the room at a distance from the body. There was a stain of fresh blood on the knot of the tape where it passed over the hook, and there was no blood on the hands of the deceased. The windpipe for about an inch and a half was lacerated longitudinally in its rings, and there was a deep circular mark round the neck in the course of the doubled tape, as if either from great pressure applied by some person, or from the weight of the suspended body. The latter hypothesis, so far as the tape round the neck was concerned, was untenable. The body of the deceased did not weigh probably less than 120 pounds, while the tape found round her neck broke with a weight of 49 pounds: hence the deceased could not have been suspended by it. Apart from this the injuries to the parts about the neck, including the longitudinal fracture of the windpipe, were not such as the tape could have produced as a result of partial suspension in the position in which the deceased's body was found. The noose had been so placed that the greatest pressure was on the back of the neck, and the least in front, where the greatest amount of mechanical injury was actually done. The deceased had been strangled probably by manual violence in the first instance, and afterwards by the use of a ligature drawn tightly by the hand. The body was then looped up by the double tape. These facts, taken in connection with the smooth arrangement of the clothes, the severe marks of violence on the body (inexplicable on the hypothesis of suicide), and the marks of blood and struggling in the room, proved that there had been homicidal interference; and the crime was brought home to the prisoner by a series of moral and circumstantial proofs inconsistent with her innocence and only consistent with her guilt.

In directing attention to the circumstantial evidence, it was suggested that the dress of the deceased might be torn or discomposed, a fact indicative of a violent struggle and, *cæteris paribus*, incompatible with suicide; but it is proper to remark that evidence of murder, as in *Pinckard's* case, may be obtained by finding a smooth and undisturbed state of the dress, as well as attitude of the body. In fact, whosoever attempts to imitate suicide under such a form of murder must, when the facts are properly investigated, inevitably fail in his object. The assassin either does too little, or he does too much. The woman who committed the murder in *Pinckard's* case had been a nurse in an infirmary, and accustomed to lay out dead bodies. After the murder she appears to have carried out, unthinkingly, her professional experience, by smoothing the clothes under the body, placing the legs at full length, the arms out straight by the side, and the hands open and laid out! Such a condition of the body was quite inexplicable on the supposition of suicide, considering the amount of violence which must have attended the strangulation. In the case of *Drory*, the criminal had attempted to make the death appear like an act of suicide by placing the lower end of the rope near the hand of the deceased: but he selected the *left* hand when the deceased was right-handed, and he did not leave enough rope free from the neck for either hand to grasp in order to produce the violent constriction of the neck caused by the two inner coils. Both of these criminals confessed their crimes before execution. Other reports of cases of alleged death from homicidal strangulation will be found in the 'Medical Gazette,' vol. 41, p. 295, and vol. 44, p. 1084.

It is proper to notice, in this place, the frequent occurrence within a recent period of what are called '*Garotte robberies.*' The system of murder normally pursued by the Thugs in India appears to have been imported into England, and many lives have been destroyed in the manufacturing districts and in large towns by the employment of strangulation for the purposes of robbery. In spite of some convictions, there is reason to believe that many criminals set the law at defiance. The rigorous proof required of facts, which under these assaults can rarely admit of proof, confers complete impunity on the assailants. The attack is made during darkness: the person is seized by the windpipe from behind, or a bandage is thrown around his neck; and this is suddenly tightened, while accomplices are engaged in perpetrating robbery. The nature of the assault by pressure on the windpipe, renders it impossible to give an alarm or call for assistance. The person assaulted, if he should recover, is seldom able to identify an assailant: he is attacked from behind, is rendered immediately senseless and powerless, and can rarely offer resistance. Recovery or death in such cases depends on the lapse of a few seconds, more or less, during which the constriction of the neck is continued—on the degree of constriction, and on the age, sex, and strength of constitution of the person assaulted. An attempt at strangulation, as in garotting, besides inflicting serious local injury to the windpipe and other parts near to it, may cause a state of insensibility which may continue for some hours. There is severe pain in the throat, with difficulty of speaking and swallowing, and if the larynx be seriously injured there may be loss of voice. Dumbness, however, is not one of the secondary symptoms: and loss of voice is usually only temporary during the pressure. By the 24th and 25th Victoria, c. 100, s. 14, it is enacted, *inter alia*, that 'whosoever shall attempt to drown, suffocate, or strangle any person, with intent to commit *murder*, shall, whether any bodily injury be effected or not, be guilty of felony; and being convicted thereof shall be liable, at the discretion of the Court, to be kept in penal servitude for life, or for any term not less than three years, . . . or to be imprisoned for any term not exceeding two years.' As the intent in these cases is to perpetrate *robbery*, and not murder, another section (21) has been framed, for the prevention of the crime of *garotting*: 'Whosoever shall, by any means whatsoever, attempt to choke, suffocate, or strangle any other person, or shall, by any means calculated to choke, suffocate, or strangle, attempt to render any other person insensible, unconscious, or incapable of resistance, with intent, in any of such cases, to enable himself, or any other person, to commit, or with intent in any of such cases thereby to assist any other person in committing any indictable offence, shall be guilty of felony; and being convicted thereof shall be liable, at the discretion of the Court, to be kept in penal servitude for life, or for any term not less than three years, . . . or to be imprisoned for any term not exceeding two years,' &c.

Marks of violence.—It may be inquired whether *marks* of violence on the body, or blood-stains on the clothes, furniture, or in the apartment, do not afford strong evidence of *homicidal* strangulation. The answer is—if the marks of violence are such that they could not possibly have arisen from any accident before death, or that they could not possibly have been self-inflicted, they afford the strongest evidence of murder. But the cases wherein so positive an answer can be returned are exceptions to the rule. It is not always in our power to distinguish *accidental* or *self-inflicted* from homicidal violence; and we are always bound to look to the probability of accident, or of previous attempts at suicide, being the source of those personal injuries which may be apparent on a strangled body.

In the following case, communicated to me by Dr. Campbell of Lisburn, the marks of injury to the neck clearly established homicidal strangulation. The dead body of an old man, aged seventy years, was found lying in a potato-field adjoining his house, on the 10th of October 1842. His family consisted of a son, the son's wife, and a male servant, brother to the son's wife. The deceased had gone to gather potatoes for the servant, who was digging. On its being known to their neighbours that the body had been found in the field, suspicions were excited that his death had resulted from violence. An inspection of the body was ordered. On opening the skull a large quantity of dark fluid blood escaped, the membranes of the brain were greatly congested, the sinuses or large veins were gorged with blood, and the brain itself was also congested. Several clots of blood were observed in the lateral ventricles, and some over the surface of the brain. In the chest the lungs were filled with dark fluid blood, the air-cells were ruptured, and there was considerable emphysema (diffusion of air). The right side of the heart was distended with dark blood. There was nothing remarkable in the abdominal viscera, but the lining-membrane of the stomach, which was about half filled with potatoes, was congested. On the neck, over the left side of the thyroid cartilage, there was a slight mark of a crescentic form, with a corresponding though slighter mark on the opposite side. On removing the skin a large quantity of coagulated blood was seen immediately beneath the marks, and in the substance of the muscles. On removing this the left side of the cartilage, which was ossified, was found much depressed, and traversed by a fracture nearly an inch in length. From the general appearances presented by the body, together with the injury to the thyroid cartilage, an opinion was given that death had arisen from manual strangulation—and, from the particular form of the external marks over the neck, *by a left hand.* Several witnesses were examined, who proved that the deceased and the servant were on bad terms, the deceased having threatened to dismiss the servant, and that before they had gone to dig potatoes, the servant said he would be revenged of his master. The servant was committed for trial at the assizes. One of the magistrates present desired that the prisoner might be requested to throw a stone, in order to ascertain if he was left-handed, which he did with the *left hand.* At the trial the sister of the prisoner swore that she saw her brother strangling the old man, and several witnesses proved that he had maltreated the deceased on many previous occasions. The counsel for the defence advocated the prisoner's case so well, and proved the sister to be of so bad a character, that the jury, having some doubt as to her veracity, acquitted him. Dr. Campbell forwarded to me the ossified larynx, which was fractured, as above described, evidently by great manual violence. For the account of another case by Dr. Keiller, in which fracture of the larynx was properly regarded as a strong fact in favour of homicidal strangulation, see 'Edin. Med. Journal,' Dec. 1855, p. 527.

There may be *several marks* on the neck, but then the person may have tried to strangle himself more than once. The throat may be cut—there may be a deep-seated stab or gunshot wound, involving some of the important organs of the body—or poison may be found in the stomach; but in a purely medical point of view, how are we to know that the deceased did not actually make the marks, inflict the wounds, or take the poison before he succeeded in strangling himself? In the chapters on Drowning and Hanging, we have seen what suicides can do when they are desperately bent on destroying themselves. Wounds and personal injuries often create serious difficulties to a medical jurist, which it requires the greatest caution and prudence on his part to meet and explain. The prejudice of the public mind is such, that the discovery of a strangled person, with marks of personal injury or of poisoning in his stomach, would, in most cases, lead to a charge of murder, unless the facts rendered it clearly impossible that any attempt could have been made on his life. It is against this prejudice that a medical witness must strenuously guard himself: he may be abused for not joining in the outcry of the vulgar, but the best recompense for this abuse will be the conviction that he is interposing the shield of science to protect a possibly innocent fellow-creature from the senseless denunciations of ignorance. Further, before a charge of murder by strangulation is raised against any person from marks or appearances found on a dead body, care should be taken that they admit of no other probable explanation than the direct application of violence. Even if marks indicative of strangulation are discovered, the question arises whether they may not have been produced by the deceased upon himself in an attempt at suicide which may have failed. If the body of a person is allowed to cool, with a handkerchief, band, or tightly-fitting collar round the neck, a mark resembling that of strangulation will be produced. Before any opinion is given that murder has been perpetrated or attempted, the proofs on which reliance is placed should be distinct, conclusive, and satisfactory. (See the cases of Mrs. Byrne and Mahaig, pp. 71, 74.) In the dead bodies of infants and children, in whom the neck is short, a mark is occasionally seen which arises from the bending of the head; and in short-necked persons a similar mark or depression has been noticed after death, in front of the neck. These marks are then rendered more prominent by their assuming a livid appearance. They might, at first, be mistaken for marks produced by a ligature in attempted strangulation. In one case a death from apoplexy was attributed to homicidal strangulation from a cadaveric change of this kind. ('Ann. d'Hyg.' 1859, vol. 1, p. 139, and vol. 26, p. 149.) The matter was set right by the late M. Ollivier. Homicidal strangulation may be perpetrated on the weak and infirm without causing any noise or creating alarm. In the first place, if the throat is at once seized and firmly compressed no cry can be made, nor any noise produced to excite the attention of those who are near. In June 1857, an aged woman was strangled in her shop by an apprentice in so short a time and with such facility, that her husband, who was only separated from her by a slight partition, heard no noise or disturbance during this act of murder. ('Ann. d'Hyg.' 1859, vol. 1, p. 157.)

It cannot be disputed that in contested questions of suicidal or homicidal strangulation, rare as they are, we must be often greatly indebted to evidence founded on circumstances, as well as to moral presumptions. How far a medical jurist may be allowed to make use of these in the formation of an opinion it will be for the Court to determine. Generally speaking, his duty is rigorously confined to the furnishing of medical evidence from medical data alone; but instances present themselves in which this rule must be departed from, or the course of justice will be impeded. Besides, there are numerous circumstances of a collateral nature which may materially modify a medical opinion. Thus the sight of a ligature, the state of the dress, and the attitude of the deceased when discovered, although not strictly medical circumstances, bear directly upon medical opinions; and that evidence ought not to be objected to which is partly founded upon facts of this nature. It must occur to all, that without circumstantial evidence, the best medical opinion in these cases will often amount to nothing. It may be, for example, no more than this: the case is either one of homicide or suicide; and why is such an indefinite answer to be returned? Because, in the abstract view of strangulation, it is not easy to determine whether a ligature was *suicidally* applied round the neck or not. The appearances may be in many cases the same, and where they are different, this difference may be due to accident, so that it is a mistake to suppose that we must look to medical circumstances *alone* for clearing up this intricate question. On some occasions the theory of homicide or suicide will be equally consistent with the facts. The cases of *Dr. Franck* and his son, which occurred at Brighton in November 1855, were of this ambiguous character. Whether the son strangled himself, or was strangled by his father, was a question which could not be satisfactorily solved by medical, moral, or circumstantial evidence. Unfortunately, the bodies did not undergo a proper medico-legal inspection.

The following case, reported in the 'Annales d'Hygiène' (1829, v. 2, p. 447), was pronounced to be a case of *suicidal* strangulation by some, and of *homicidal* by others. A servant-girl was found dead in her bed. The body of the deceased was rigid and lying in a constrained position, with the face turned to the right, and there was a handkerchief so firmly tied around the neck that it was with some difficulty removed. A quantity of air and bloody mucus escaped from the mouth and nostrils. The knot in the handkerchief which was tied round the neck was on the *left side*, as it is customary to find it in left-handed people. The deceased was not left-handed, and there was no reason to suspect that she had intended to commit suicide; she went to bed the night before in her usual health and spirits. There was no mark of violence externally, but there were large patches of cadaveric lividity scattered over the skin. There was a deep impression of a necklace on the skin of the neck, which had resulted, it was supposed, from the force with which the handkerchief had been tied. The neck appeared swollen, especially on the right side. On opening the head, the vessels of the brain were found distended, especially on the right side; and on this side about half-an-ounce of blood was found extravasated. In the mouth the tongue projected forwards between the teeth, but was uninjured by them. The contents of the chest and abdomen presented nothing unusual: the lungs were gorged with blood.

The examiners attributed death to strangulation, and in their judgment the act was not suicidal. Among the reasons assigned for this opinion was the fact that the handkerchief was tied on the neck in *two knots*, and the deceased could *not* have made more than one; her senses would have failed her before she could have made a second, or at least before she could have made it so perfectly as the first. The position in which the body was found, the cheerful conduct of the deceased on the night before her death, and the absence of all motive to induce her to commit suicide, were facts also adverse to self-destruction; but as no criminal could be pointed out it was suggested that the act was suicidal. The College of Brunswick, being appealed to by the legal authorities, concluded that deceased could not have died from strangulation, and assigned an attack of apoplexy as the probable cause of death, from the extravasation of blood met with in the brain. They considered that the girl had *herself* tied the handkerchief round her neck for the purpose of keeping herself warm, as the night on which she died was extremely cold. They admitted the probability that she might have imprudently tied the handkerchief too tightly—a circumstance which had perhaps facilitated the congestion of the cerebral vessels and extravasation of blood. The reason assigned by the College for their opinion was that the handkerchief had produced no ecchymosed mark on the neck; but as it is now well-known that a person may be strangled and no ecchymosis be produced, the argument that the deceased had not died by strangulation falls to the ground. The reason assigned for the handkerchief being placed around the neck appears wholly inconsistent with the facts. It is scarcely to be imagined that any individual who did not contemplate suicide would retire to rest with a handkerchief tied in a double knot *so tightly* around the neck as to render it very difficult to remove: it was evidently so tight that strangulation might easily have resulted from the constriction. The apoplectic appearances in the head may have been due to the impeded circulation of the blood, in consequence of the ligature. There was, therefore, nothing to contradict the opinion of death from strangulation: no morbid cause capable of giving rise to sudden death (excepting effusion of blood on the brain, which has already been accounted for) was discovered in the body. Whether the ligature was placed round the neck by the female herself, or by another, may be a matter of doubt: yet when we consider that there was nothing absolutely impossible in the act on her part, that there were no appearances of violence about her person or clothes, and no evidence of any individual having had access to the apartment, it appears most probable that the strangulation was *suicidal.*

In *Reg.* v. *Cooper* (Shrewsbury Lent Assizes, 1863), the prisoner was convicted of the murder of his son by strangulation. In this case a twisted cotton handkerchief was found round the neck of deceased. It was tied tightly, and with a double knot: a finger could not be introduced between it and the neck. The face had a bloated appearance,—the tongue protruded, and the teeth were deeply indented into it. The deceased was a boy only eight years old. The surgeon rightly concluded that this was a case of homicidal strangulation. The carelessness with which these inquiries are sometimes conducted is shown by the fact that in *Reg.* v. *Browning* (Central Criminal Court, Dec. 1845), in which the prisoner was convicted of murder by strangulation, the verdict of the coroner's jury was to the effect that deceased had strangled herself in a fit of temporary insanity. In this case the cord had been twisted tightly twice round the neck and then tied in a knot!

A case was tried at the Northampton Lent Assizes, 1853 (*Reg.* v. *Gibbins*), which presents some features of interest. The prisoner was charged with the murder of a boy, æt. 8, her illegitimate son. He was alive and well at about 4.30 in the afternoon, at which time he was taking tea with the prisoner and her sister. A little before 8 o'clock in the evening he was found dead in his bed, lying on his back with his arms across the lower part of his chest. A silk handkerchief was tied tightly round his neck, and the bed-clothes were a little turned off him. There was a mark or depression round the neck where the handkerchief had been tied, but no ecchymosis beneath. The brain and its membranes were much congested; the lungs but slightly congested; the stomach contained some food partly digested; the mucous membrane is stated to have been found considerably inflamed (?), and the inflammation extended to the upper part of the small intestines. One medical witness said that, taking into consideration the fact of the handkerchief being found round the neck, and the position of the body, he was of opinion that death was caused by violence (strangulation); and he did not think that the boy could have strangled himself. If he had tied the handkerchief tight enough to produce strangulation, he could not have returned his hands to the position in which they were found. Another medical witness considered that deceased had died from poison. He formed this conclusion from the extensive inflammation of the stomach and intestines, and from the absence of any other cause sufficient to account for death. He did not think the congestion of the brain was sufficient, nor did he think that the deceased had died from strangulation. There was an absence of the usual mark (ecchymosed?), and the face was pallid; the congestion of the lungs was slight, and there was no blood in the right cavities of the heart. A chemist stated that he had examined the contents of the stomach, but there was no mineral poison; the inflammation of the stomach might have arisen from poison, or from natural causes. As the medical evidence entirely failed to prove that the deceased had died from violence, the prisoner was acquitted.

It is not at all probable that in this case the appearances in the stomach were the result of inflammation from irritant poison. Any irritant, mineral or vegetable, which would have destroyed life in three-and-a-half hours, without causing vomiting and purging, would have been found in the stomach. The partly-digested meal taken at 4.30, when the boy was seen healthy and well, was there found unmixed with any poison. How, and when, was the silk handkerchief tied round the neck? It was not the result of accident, nor could this kind of suicide be suspected in so young a child. The attitude in which the body was found, and the age of the child, are adverse to the supposition of suicide. The handkerchief was not tied round the neck after death—

there could be no motive for such an act; it must have been tied while the child was living. The absence of any ecchymosis in the course of the ligature is not opposed to this view. The state of the brain appears to show death from apoplexy as a result of an interruption to the cerebral circulation by the ligature. The usual appearances of asphyxia in the heart were wanting. The redness of the stomach was probably owing to congestion, and not to inflammation, and may have been due to the process of digestion going on at the time of death; or it may have been the result of congestion, as observed by Dr. Yelloly in the bodies of executed criminals, and by others in cases of strangulation (*ante*, p. 655). There can be no doubt, considering all the circumstances, that this was a case of homicidal strangulation, the fatal effects being produced chiefly through the brain.

In all cases of fatal strangulation resulting from an act of suicide, the means by which strangulation was produced must be found upon the neck. The condition of the mark on the neck, the course and direction of the cord, the mode in which it was secured or fixed in order to produce effective pressure on the windpipe, the amount of injury to the muscles and parts beneath, are circumstances from which, if observed at the time, a correct medical opinion may generally be formed. If the means of constriction are removed, or the cord or ligature is loosely applied, these facts, unless explained, are presumptive of homicidal interference.

There is another condition in which a presumption of homicide will be justifiable. A man, in strangling himself, is not likely to vary the means. The act is commonly due to a sudden impulse, if we may judge from the moral proofs afforded in the instances on record. The article which is nearest to the suicide is seized, and made the instrument of self-destruction. It has already been stated as doubtful whether a person could strangle himself by the mere application of the fingers to the windpipe: the discovery of such *marks only* as would indicate this kind of strangulation, therefore, renders suicide in the highest degree improbable. But these marks may be sometimes ascribed to the deceased having fallen with his hand possibly applied to his neck, and the inference will be drawn that they have accidentally resulted from the pressure of his own fingers. This is an improbable mode of accounting for the production of ecchymosis or excoriation of the skin in the front of the neck. If, besides these marks of fingers, we find a circular mark, with a ligature still around the neck, the presumption of murder becomes very strong. It may be said that a person might at first try to strangle himself with his fingers, and, not succeeding, might afterwards employ a cord. But the degree to which the coincidental impressions exist will assuredly in general remove this objection. A murder was committed many years since in this country in the manner here stated. A gentleman of fortune was found strangled on board of a ship in the port of Bristol. Besides the mark of a rope drawn tightly round the neck, there were distinct impressions of nails and fingers in front of the throat. An investigation took place, and the result proved—as, indeed, this state of the neck rendered it almost certain—that the deceased had been murdered. It was afterwards confessed by one of the murderers that they had first strangled him with their hands, and then drew the rope about his neck, to ensure the certainty of his death. (See 'Ann. d'Hyg.' 1841, vol. 2, p. 149.)

Imputed homicidal strangulation.—Hitherto the subject of strangulation has been considered in reference to the dead. But a living person may charge another with attempting murder under such circumstances, and here a medical jurist will have the not very arduous duty of detecting and exposing the imposture. It has been considered so improbable that any one would seriously attempt to strangle himself, and then impute the act to another, that medical jurists have given but little attention to this subject. A case which has been recently tried in France (*Affaire Armand et Maurice Roux*, March 1864) has shown the great importance of it, and how easily medical men may be deceived by a plausible story. As in reference to imputed wounds, so in these cases impostors rarely produce such injury to themselves as to place their lives in jeopardy. The cord is loose round the neck, or there would be speedy death; it is not so secured as to press with great force on the air-passages, to cause the tongue to protrude, or to produce lividity of the face and neck, or ecchymosis in the conjunctivæ and the skin. It is either a ligature or a rope which is used by the impostor: he does not commonly resort to manual violence to his throat. The marked feature of a really homicidal attempt is in the great amount of violence done to the neck; and the account given by the impostor will be inconsistent in its details, and not reconcilable with the ordinary effects of homicidal strangulation. Tardieu met with a case, in which a young female of good social position, wishing to excite some public sympathy, alleged that she had been made the victim of a political conspiracy. One evening she was found at the door of her room, apparently in a very alarming state: she could not speak, but indicated, partly by gestures and partly by writing, that as she was entering her room a man had attempted to strangle her by pressing his hand upon her neck, and at the same had stabbed her in the chest with a dagger. On close examination the two stabs had penetrated only to the outer clothing. But the most singular effect of the alleged attempt at strangulation was that, instead of producing a difficulty of speaking and alteration of the voice, it had been followed by complete dumbness! M. Tardieu, who was officially authorised to examine the case, could find on the neck no trace of any attempt at strangulation; and on assuring the young lady that the loss of voice under such circumstances could not last for more than a minute, she at once admitted that there was no foundation for the charge! ('Ann. d'Hyg.' 1859, vol. 1, p. 163.) On this occasion no person was accused: but the case is different when, for the purpose of extortion or other base motives, one or more persons are charged with an attempt at murder. A flagrant instance of this kind is that above-mentioned, in which a wealthy merchant of Montpellier was charged by his servant, *Maurice Roux*, with having attempted to murder him by strangulation. The case was tried in March 1864, before the Court of Assizes of the Bouches du Rhone; and, fortunately for the interests of justice as well as for the credit of medico-legal science in France, it ended in a complete acquittal of the accused. (*Affaire Armand et Maurice Roux*, Paris, 1864. 'Relation Medico-légale de l'Affaire Armand,' &c., par A. Tardièu, 'Annales d'Hygiène et de Médecine Légale,' 1864, vol. 1, p. 415.) On the 7th July 1863, at 8 o'clock in the evening, *Roux*, the accuser—a man in the prime of life, and a servant of the prisoner—was found in a cellar of his master's house stretched on the floor, his feet and hands tied: he was apparently strangled and, it is said, almost lifeless. Under medical care, in less than three hours he, however, completely recovered. On the next morning (as he professed to be unable to speak) he informed those about him, by signs, that his master came upon him unexpectedly while he was in the cellar, scolded him, struck him a severe blow on the nape of the neck (which knocked him down), attempted to strangle him, and then bound him with cords, and left him on the floor as he was found. These injuries, according to him, were inflicted at half-past eight in the morning, so that on his own statement he had been lying on the cellar-floor, in a helpless state and unable to give an alarm, for more than eleven hours. *M. Armand* denied the charge, affirming that the whole statement was a falsehood,—and certainly no motive could be suggested for such conduct on the part of a gentleman of position and education. No corroborative evidence could be adduced in support of the charge, and it rested simply on the word of one man against the word of another. M. Tardieu, who with other medical experts gave evidence for the defence, has published a summary of the case.

When the accused was found, he was lying on his left side with his face towards the floor, and his legs were tied by a handkerchief which belonged to the accused—and which, from *Roux's* position in the household, it was very easy for him to procure from his master's wardrobe. His arms were cold,—his head and face of a natural warmth,—the breathing stertorous or loud—the pulse scarcely perceptible, and the eyelid and eye almost insensible. There was around the neck a cord about one-quarter of an inch in diameter: it was coiled three or four times round, and not secured by any knot. There were some marks about the neck, not ecchymosed, and widely separated from each other. There was no injury to the skin, and there were no marks on the neck such as the coils of this cord would have produced had it been applied with any force by an assailant. The cords bound around the legs and wrists were such as any one might apply to himself; they, therefore, require no further notice. As there was no swelling around them, it was obvious that they could not have been applied for upwards of eleven hours, as stated by the accuser, but only within a short time of his being discovered in the cellar.

The time assigned by this man for the malicious assault was fatal to his story. The cord round the neck had not been applied with sufficient force to interrupt respiration in any degree. This was not only proved by the absence of any marks on the neck corresponding to it, but by the circumstance, according to his statement, that he had been in the same position eleven hours. Had this been true, and the cord applied so as to produce imminent symptoms of strangulation as he described, he would have died from the effects within an hour after he had been so maltreated. Men who strangle others either draw a cord tightly, or secure it by a knot. The pressure to the neck is not so gentle as to leave no mark whatever, or to allow the strangled person to breathe and watch all that goes on around him for a period of eleven hours! There was therefore nothing in this man's state but what might have been self-produced; while, on the other hand, all the facts were inconsistent with the supposition of a homicidal attack having being made upon him by another. There was no trace of any blow on the nape of the neck; while the violence described, if really inflicted, would have left some strong evidence of its existence. In the absence of this there was a want of all corroboration of the charge. Although he stated that he was rendered insensible by the blow, yet he was able to observe and describe minutely the proceedings of the accused as to the subsequent strangling, and the binding of his legs and arms. No injury was done to the larynx in any way; yet the man professed to be dumb, and unable to speak. Dumbness is not one of the after-consequences of an act of strangulation from which a person recovers. This was nothing but a continuance of the imposition to excite the sympathy of the public, in which he seems to have been successful.

It is highly probable that only shortly before he was discovered, this man had arranged the ligatures about his body. He knew the time at which the cellar would be visited for domestic purposes; and, having thus bound himself, he made this charge against his master, probably for the purpose of extorting money.

To assert, as some medical men did in support of this palpably false accusation, that a man intending murder by strangulation might use a cord *gently* for such a purpose and produce no injury to the neck, is equal to affirming that no corroborative medical evidence is necessary to sustain such a serious charge. If this is admitted no one is safe from an accusation of murder. As a rule, a man does not half-strangle any more than he half-stabs or half-poisons another. If, as is most improbable in attempted homicide, the cord is left only loosely coiled around the neck, the person assaulted necessarily retains the power of breathing and calling for assistance; but if the hand of a murderer has been at work, it is effectually tightened, and the person dies in a few minutes. A charge of this kind, where there can be no witness but the person making it, requires to be supported, not by medical probabilities or possibilities, but by the strongest medical facts. These ought to show that there are marks of violence on the neck such as an assassin would be likely to inflict, and, at the same time, such as the person making the charge would not be likely to produce, or have the power of producing on himself.

SUFFOCATION.

CHAPTER 54.

SUFFOCATION FROM MECHANICAL CAUSES—VARIOUS FORMS OF—CAUSE OF DEATH—APPEARANCES AFTER DEATH—EVIDENCE OF DEATH FROM SUFFOCATION—ACCIDENTAL, SUICIDAL, AND HOMICIDAL SUFFOCATION—MEDICAL AND PHYSICAL EVIDENCE OF THE CAUSE OF DEATH—SMOTHERING.

By suffocation we are to understand that condition in which air is prevented from penetrating into the lungs, not by constriction of the windpipe, but by some mechanical cause operating on the mouth externally, or on the throat, windpipe, or air-passages internally. In this sense it will be perceived that drowning is one form of death by suffocation, the water being an effectual medium for preventing access of air to the lungs.

The term suffocation is applied to various conditions in which the symptoms and effects differ. There may be a simple privation of air,—the air respired may not be renewed for the want of proper ventilation,—or, lastly, the air which is breathed may be mixed with certain noxious gases or vapours, which, by absorption into the blood through the air-cells of the lungs, may destroy life like poisons. The symptoms preceding death, the disposition to recovery, and the post-mortem appearances in fatal cases, will differ under these circumstances. It will be sufficient at present to consider the most simple form of suffocation which is within the reach of experiment—namely, that which depends on the privation of air by substances blocking up the air-passages, or by the covering of the mouth and nostrils. The Committee of the Medico-Chirurgical Society performed a series of experiments on dogs, in which a tube was inserted into the windpipe, and breathing either took place or was completely arrested, according to whether the tube was kept open or closed by an accurately-fitting plug. When the tube was closed the animal, after a variable number of seconds, made strong efforts to breathe; and when these ceased, unless air was speedily admitted, it died. From nine experiments on the dog, the average duration of the respiratory movements, after the animal had been completely deprived of air, was four minutes and five seconds. The average duration of the heart's action was seven minutes and eleven seconds; and it further appeared that, on an average, the heart's action continued for three minutes and fifteen seconds after the animal had ceased to make respiratory efforts. In respect to the rapidity with which death takes place in animals, the following conclusions were drawn:—1st, a dog may be deprived of air during a period of three minutes and fifty seconds, and afterwards recover without the application of artificial means; and 2ndly, a dog is unlikely to recover, if left to itself, after having been deprived of air during a period of four minutes and ten seconds. As in drowning, the shorter the interval between the last respiratory efforts and the readmission of air, the greater the chance of recovery. ('Med.-Chir. Trans.' 1862, vol. 45, p. 454.)

The results of these experiments in reference to the duration of life under privation of air may be considered applicable to a human being. It is not likely that a man would survive under these circumstances longer than a dog, and it may be fairly inferred that the life of a man would be destroyed in from four to five minutes after the power of breathing had been completely arrested.

There are many varieties of death by suffocation, all of which are of great medico-legal interest:—1. The close application of the hand over the mouth and nostrils, or the placing of a plaster or cloth over these parts, combined with pressure on the chest: this was formerly not an unfrequent form of homicidal suffocation. 2. Smothering, or the covering of the head and face with articles of clothing, &c., which effectually prevent breathing. 3. The accidental or forcible introduction of foreign bodies into the mouth and throat. 4. The flow of blood into the windpipe from a severe wound in the throat, or from the bursting of a bloodvessel or aneurismal sac. 5. In wounds of the throat, when the windpipe is completely divided, the lower end may be so drawn into the wound as to produce a closure of the orifice, and intercept the passage of air. One or other of these causes frequently operates to render a wound in the throat fatal. 6. The plunging of the face into mud, snow, dust, feathers, or similar substances. In all these cases death takes place from asphyxia, and with great rapidity if the chest sustains at the same time any degree of forcible compression. 7. Swelling or spasm of the glottis produced by the contact of corrosive substances. A case was referred to me, in July 1848, in which death was probably thus caused by the application of a strong solution of pernitrate of mercury to an ulcer in the throat.

Suffocation from mechanical causes.—Suffocation may arise from morbid causes, such as a diseased state of the parts about the throat, an enlargement of the glands, the bursting of a tonsillary abscess, or the effusion of lymph, blood, or pus into the windpipe, or about the opening of the larynx (rima glottidis). Any of these causes may suddenly arrest the act of breathing, a fact which can only be determined by a proper examination of the body. Among many cases of death from suffocation produced by mechanical causes which have been reported, the following are deserving of notice:—1. A boy died in half-an-hour under alarming symptoms somewhat resembling those of poisoning, and it appeared that a simple medicinal powder had been given to him about five minutes before the attack! On inspection Dr. Geoghegan found the lower part of the windpipe blocked up with cheesy scrofulous matter: it was evident that the child had died from suffocation as a result of disease, and not from the medicine. 2. The following case was communicated by Mr. Edwardes to the Medico-Chirurgical Society:—A child of eight years of age, while at play, was suddenly seized with symptoms as of a fit. He was quickly carried home, and became violently convulsed. Although retaining consciousness and speech, his countenance was extremely anxious, and he uttered the expression that he should die. In the hurry of the moment there was no opportunity of getting any distinct knowledge of the previous history, beyond the surmise that the boy had swallowed something. The windpipe was immediately opened; a little air issued from the opening: artificial respiration was attempted, but without effect, as the child gave but two gasps after the operation, and died. An inspection revealed the presence of a foreign body in the upper part of the air-passages. The substance was whitish, and covered with mucus. On examination it was evident that the body was a bronchial gland. Upon slitting open the windpipe the spot whence the gland had issued was perceived. 3. A man, æt. 31, was put to bed drunk, having previously vomited; and shortly afterwards he was found dead. On inspection Dr. Jackson of Leith discovered the usual appearances of asphyxia, i. e. congestion of the lungs and of the right cavities of the heart. He was thus led to examine the air-passages carefully, and he found, lying over the upper opening of the windpipe (rima glottidis), a thin and transparent piece of *potato-skin* so closely applied to the fissure as to prevent respiration. The man had died, accidentally suffocated from this mechanical cause. He had had potatoes for dinner the day before; the piece of skin had probably been thrown up at the time of vomiting, and had been drawn back by inspiration into the singular position in which it was found. Owing to intoxication, the deceased was probably unable to cough it up. I agree with Dr. Jackson in thinking that this case conveys a caution in making inspections. In England the verdict would most probably have been, 'Died by the visitation of God,' without an examination of the body! The result clearly shows that in every case of sudden death there should be a strict investigation. ('Ed. Med. and Surg. Journ.' April 1844, p. 390.) Mr. Nason communicated to me a case (Sept. 1860), in which a child seventeen months old died suddenly during a violent fit of coughing. On a minute inspection to determine the cause of death, a full-grown pea was found firmly fixed in the larynx, between the cricoid and thyroid cartilages, blocking up the air-passages. It was probable that it had been in the air-tubes some time, as there was muco-purulent matter effused, and under a sudden fit of coughing it had been thrown into the position in which it was found, thereby causing death by suffocation. Dr. Richardson met with a case of death from suffocation caused by the vomiting of the contents of a full stomach, a portion of the food having blocked up the throat. A case similar in its details occurred to Mr. Matthews. ('Lancet,' Aug. 31, 1850, p. 262.) Children are often suffocated from small portions of solid food penetrating into the air-passages; and unless an inspection of these parts is made, death may be easily referred to some natural cause. (See case by Mr. Synnott, 'Med. Gaz.' vol. 40, p. 994; also 'Lancet,' May 16, 1846, p. 561.) In some instances a retraction of the base of the tongue may lead to the suffocation of a new-born child. ('Seller's Journal,' March 1854, p. 278.) Accidental suffocation from the impaction of large masses of food is by no means uncommon. If the glottis (the opening of the windpipe) be completely closed by food, death may take place suddenly. It does not follow, however, that a person so situated is incapable of making some exertion or of moving from the spot. Dr. Mackenzie relates a case in which a man was suddenly choked by swallowing a large piece of meat: he immediately walked across the street to a chemist's shop, and soon after entering it, he fell down in a state of insensibility. After death the throat was found to be filled with a piece of beef, which rested on the glottis, and had pressed the epiglottis forward. Part of the mass had entered the windpipe through the rima glottidis, and had thus caused death by suffocation. It is probable that, in this and similar cases, the foreign body does not so completely close the aperture as to prevent some degree of respiration, but the blood being imperfectly aërated, asphyxia is speedily induced. ('Ed. Month. Jour.' July 1851, p. 68.) In a case which occurred in April 1858, a youth, æt. 17, lost his life owing to an oyster becoming impacted in the air-passages during the act of swallowing.

A person has been wrongly charged with causing the death of another, when the cause was really owing to the impaction of food in the larynx. A remarkable instance of this kind (which is reported in the 'Lancet' for March

, 1850, p. 313), occurred at Hillingdon. Deceased had had a quarrel with the accused, who was his son-in-law, and they were seen to fall to the ground together, while struggling and fighting. They were separated. About two hours afterwards the deceased, who appeared quite well, was observed to rise from the dinner-table and leave the room. He was found leaning against the cottage, as if in a falling position, and he expired in two or three minutes! The party with whom deceased had been fighting was charged with manslaughter before a magistrate. At the inquest the medical witness stated that he found the organs of the body, excepting the brain, in a very healthy state. The brain was excessively congested, and he attributed death to apoplexy. The coroner desired the witness to examine the mouth and throat (which he had omitted to do at the inspection), as from the suddenness of death after eating, he (the coroner) thought the man might have been choked. This opinion turned out to be correct. A large piece of meat was found wedged in the opening of the throat; this had caused death by suffocation. It had not completely closed the air-passages in the first instance: hence the man was able to move from the dinner-table. The person accused of manslaughter was discharged. A medical jurist, however, must not lose sight of the fact that a foreign substance may be *homicidally* impacted in the larynx, and that, except by a careful examination of the body, death may be wrongly assigned to accident. A case reported by Dr. Littlejohn is in this respect instructive. In examining the body of a woman who it was stated had died suddenly, he found a quart-bottle cork inserted tightly into the upper part of the larynx. The sealed end was uppermost, and was roughened by the passage of the screw. Fractures of the ribs were found, and it was quite clear that deceased had not died a natural death. It was suggested that the deceased, while extracting the cork from the bottle with her teeth, might, by the sudden impetus of the contained fluids, have drawn it into the position in which it was found. But this theory was negatived by the sealed end of the cork being uppermost in the throat, as well as by the structure of the parts. The medical opinion was that the cork must have been forcibly placed there by another person, while the woman was in a helpless state of intoxication. There was no reason to doubt that this was a deliberate act of murder. Five persons were present with the deceased at the time of her death, but it was impossible to fix with certainty upon the person who had committed the act, and the man on whom the strongest suspicion fell was acquitted on a verdict of 'not proven.' ('Ed. Med. Jour.' Dec. 1855, p. 511; and for a report of the trial, the same journal, p. 540.)

Cause of death.—Treatment.—It has been already stated that death takes place by apnœa or asphyxia; and this occurs with a rapidity proportioned to the degree of impediment existing to the passage of the air. There does not seem to be any reason to attribute death to apoplexy. The congestion of the cerebral vessels may be regarded as a consequence of the disturbance of the functions of the lungs. If the veins of the neck were opened, so as to prevent an accumulation of blood in the vessels of the brain, it is pretty certain that the prevention of respiration would destroy life under the same circumstances, and within the same period of time: therefore we may regard death from suffocation as resulting from pure asphyxia.

In *treating* cases of suffocation we have simply to allow of the renewal of air by removing, if this be possible, the obstacle to respiration. The results of experiments on dogs show that, even with a perfect closure of the windpipe, an animal may recover spontaneously after nearly *four minutes'* deprivation of air; and there is every reason to believe that a human being might recover after the same length of time. If five minutes have elapsed there will be but little hope of recovery. Cold affusion to the chest should be used if efforts at respiration are not made spontaneously on the removal of the obstruction.

As it has been elsewhere stated, the chances of recovery in drowning continue only for half the period observed in suffocation. The lungs are injured, and the water by which they are penetrated, forms a physical obstacle to the admission of air. In hanging and strangulation there is sometimes great violence done to the parts about the neck. In suffocation these accidental obstacles to recovery do not exist: the surgeon has simply to readmit the air into the lungs.

All experiments go to show that, even in this form of asphyxia, which is most favourable for recovery, the complete suspension of respiration for *five minutes* is fatal. Hanging and strangulation prove fatal from asphyxia in the same period of time, and drowning probably within half this period.

Post-mortem appearances.—There are rarely any considerable marks of violence externally. When the body has become perfectly cold, there may be patches of lividity diffused over the skin; but these are not always present. The lips are livid; the skin of the face and neck may be pale, or present a dusky-violet tint, with small patches of ecchymosis. The eyes are congested: there is a mucous froth about the lips and mouth. The mouth, throat, and parts about the windpipe should be carefully examined for foreign substances. Internally the lungs and right cavities of the heart may be found distended with blood. The state of the lungs and heart is, however, subject to variation. The lungs are not necessarily found congested; and sometimes, as in a case referred to me in November 1864, one lung may be found congested and the other not. M. Tardieu states, from his observations, that the *lungs* are of a reddish colour, sometimes even pale, not distended, and presenting, occasionally, only a slight degree of congestion at the base and posteriorly. A special character which he states he has invariably noticed consists in the presence of small ecchymosed spots or patches beneath the pleura or investing membrane. He describes these spots as of a dark colour, and varying in size from a pin's head to a lentil. In the adult they are of still larger size. Their number is variable; sometimes five or six may be found, at others twenty or thirty; and in other cases the surface of the lung may be so studded with them as to give to it a granite-like appearance. These spots of ecchymosis are sometimes agglomerated, at other times separated, but their outline is generally distinct and well-defined on the surface of the lungs. They are most frequently seen at the root of the lungs, at its base, and about its lower margin. They are owing to small effusions of blood from ruptured vessels, like true ecchymosis. They may be distinguished so long as the tissue of the lung remains unchanged. M. Tardieu states that he has seen these subpleural ecchymoses in the body of an infant, ten months after death. ('Ann. d'Hyg.' 1855, vol. 2, p. 379.) He admits, however, that they may also be found in the bodies of children that have not breathed; hence no inference of death from suffocation should be drawn from this appearance in the lungs of children, unless they have actually received air In three instances he met with this appearance in lungs which sank in water, and had all the usual characters of these organs in a fœtal state. The children had been born living, prematurely, and under conditions in which life by respiration could not be perfectly established: one of them had made several cries without effectually receiving air into the lungs (loc. cit.). (See Casper's 'Klinische Novellen,' 1863, p. 471.) This struggle to breathe may have produced the appearance resembling that of suffocation: in new-born children that die from suffocation the thymus-gland has been found in a similar condition.

This dotted appearance of the surface of the lungs in suffocation is not attended with the apoplectic effusions in their substance which are met with in death from strangulation. Emphysema, or escape of air from rupture of the air-cells, is occasionally observed. The more rapidly suffocation has taken place the more strongly marked is this appearance of ecchymosed spots. On the other hand, when the interruption of breathing has been slow and gradual, the substance of the lungs is more congested with blood, and then these dots or patches are merged in the general violet colour of the surface of the organs. The lining-membrane of the windpipe and larger air-tubes is sometimes pale, but commonly dark-coloured when the lungs are congested. In the air-passages there is occasionally a frothy reddish-coloured liquid in small vesicles.

The *heart* presents no special appearance indicative of the mode of death, if we except the presence of small spots of ecchymosis found below the investing membrane, like those met with on the lungs. They have been found near the roots or origin of the great vessels, but are not so frequently observed in this organ as in the lungs. The blood is generally dark and fluid; sometimes coagula are met with. The stomach and intestines have been observed to present patches of lividity. Casper has found the kidneys more strongly congested with blood than the liver, spleen, and other organs. ('Ger. Leich.-Oeffn.' 1853, 1, s. 78.) The vessels of the *brain* are sometimes congested, but at other times they do not appear to be more than ordinarily full. Their condition may be affected by the congested state of the lungs, as well as by the slowness or rapidity with which death takes place. Other appearances which have been described are of an accidental nature, and are not connected with death from suffocation. (See cases by Casper, 'Med. Gaz.' vol. 44, p. 1084; also a series of papers by Dr. B. W. Richardson, 'Med. Gaz.' vol. 47, p. 359, *et seq.*)

In a case of alleged murder by suffocation, respecting which I was consulted in December 1857, the following appearances were met with. The body was lying on the bed: the right leg was drawn up towards the body—the right arm was bent, with the hand directed towards the face; the left hand was lying upon the chest. The lips were livid, the tongue protruded and swollen, and there was a bloody fluid issuing from the nostrils. There was no mark of constriction on the neck; the eyes were half-open; the body was rigid and still warm. The face and neck were much swollen, and the skin of these parts, as well as of the chest, abdomen, arms, and legs, was covered with dark livid patches. The brain was gorged with venous blood. The heart was soft and flaccid, and its cavities were empty. The mucous membrane as well as the tissues of the air-passages were much congested with dark liquid blood: the blood was everywhere liquid. The stomach contained a small quantity of a dark-coloured liquid, and the greater end was reddened. The spleen was congested. The emptiness of the cavities of the heart was at first considered to be inconsistent with death from asphyxia; but this condition of the heart is occasionally found. It may be stated that in this case the deceased, a female, was greatly exhausted by sickness and purging. On the second day of her illness she was found dead in the state described, and her husband was charged with having suffocated her.

Evidence of death from suffocation.—In medical jurisprudence there is not, perhaps, an instance in which we have fewer medical data upon which to base an opinion than in a case of alleged death from suffocation. The inspection of the body of a person suffocated, if we except the peculiar condition of the surface of the lungs lately pointed out by M. Tardieu, presents so little that is peculiar, that a medical man unless his suspicions have been roused by circumstantial evidence, or by the discovery of foreign substances in the air-passages, would probably pass it over as a case of death without any assignable cause—in other words, from *natural causes.* In examining the body of the woman *Campbell,* who was suffocated by *Burke* in Edinburgh, Dr. Christison was unable to come to a conclusion respecting the cause of death until some light had been thrown on the case by collateral evidence. On this occasion a violent death was suspected, because there were marks of violence externally, and the face of the deceased presented some of the characters of strangulation. These conditions, however, are by no means essential to death from suffocation, and when they exist they can only be regarded as purely accidental accompaniments. Appearances similar to those found in the bodies of suffocated persons, if we except the dotted ecchymosis on the lungs, are frequently met with in inspections when death has taken place as a consequence of disease or accident. They can, therefore, furnish no conclusive evidence of the kind of death; they permit a witness scarcely to establish a presumption on the subject, until, by a careful examination of the body, he has ascertained that there is no other cause of death depending on organic disease or on violence. Medical evidence may, however, be serviceable in some instances. Thus, let the general evidence establish that a deceased person has probably been suffocated, the witness may have it in his power to state that the appearances in the body are consistent with this kind of death; that the body is in all respects healthy and sound, and that death was probably sudden—as where, for instance, undigested food is discovered in the stomach. The presence of ecchymosis on the surface of the lungs may justify a strong opinion of death by suffocation when no other cause is apparent. In all cases of this description, we must bear in mind that an opinion relative to the supposed cause of death is to be formed from the *medical* circumstances, and from what we have ourselves seen, unless it be otherwise allowed by the Court. From this want of clear evidence, great difference of opinion on the cause of death frequently exists among medical witnesses. In *Reg.* v. *Heywood* (Liverpool Summer Assizes, 1839) some of the witnesses referred death to suffocation, others to apoplexy. ('Lancet,' Sept. 14, 1839, p. 896.

Accidental suffocation.—Accidental suffocation is not unfrequent; and there are various conditions under which a person may die suffocated only discoverable after death. 1. Diseases about the tongue, larynx, or throat may have advanced to such an extent as effectually to prevent breathing. 2. The deceased may have fallen, and the mouth become covered with dust or other substances; and if helpless, as in the case of an infant or an aged person, or of one who is intoxicated, death may thus easily take place. A child was found dead in a room, with its face in the ashes under a grate: it had fallen during the absence of the mother, and, from its helpless condition, had speedily become suffocated. Some of the ashes were found in the windpipe. ('Med. Gaz.' vol. 17, p. 642.) For a case in which suffocation was caused by a pea, see the same journal, vol. 29, p. 146. In trials for murder or manslaughter, a medical opinion respecting the accidental suffocation of a drunken person, under similar circumstances, is occasionally required. These persons, it must be remembered, are generally as helpless as children: if they fall in a position so that the mouth is covered, they may be so powerless from intoxication as not to be able to escape. 3. A portion of food may have remained fixed in the larynx or throat. Children are sometimes accidentally suffocated by drinking boiling water from a tea-kettle. The parts about the larynx then become swollen from the action of the hot water, and breathing cannot take place. 4. Accidental suffocation is not uncommon among infants, when they sleep with adult persons. A child may be in this way speedily destroyed. Even the close wrapping of a child's head in a shawl to protect it from cold may effectually kill it, without any convulsive struggles to indicate the danger to which it is exposed (p. 704). Convulsions by no means necessarily attend on death from suffocation.

A coroner's inquest was held on the body of a child found dead in bed; and I assisted a friend in making an inspection of the body. It was lying in a composed attitude on the bed, with the face nearly covered. There were faint traces of cadaveric lividity about the neck and back; but the body did not present the least mark of violence. The face was pale, but the lips were livid. On examining the chest, the great vessels connected with the heart and lungs were found congested with blood. The vessels of the brain were empty. There were no morbid appearances whatever in any of the other organs. The account given by the girl who attended the child was, that she had laid it to sleep about nine o'clock in the morning, covering over the greater part of its face. She remained in the room; but in the course of an hour, not hearing the child breathe, she looked, and found it dead. The only opinion which we were asked to give was—whether, from the circumstances, suffocation was probable? We answered in the affirmative; and a verdict of 'accidental death' was returned. This case shows the ease with which an infant may be destroyed, even when its respiration is only partially impeded. The weight of the clothes may have combined to cause death by preventing the free expansion of the chest.

Those instances of accidental suffocation which depend on disease, or on the impaction of food, are easily known by an examination of the body: generally speaking, they present no difficulty. (See cases, *ante*, p. 696; 'Med. Gaz.' vol. 42, p. 970; also 'Lancet,' Sept. 2, 1848, p. 259.) But in other instances, *e.g.* when a child or a drunken person is presumed to have been suffocated owing to the position in which he has fallen, evidence as to the position of the body, or even the actual sight of the body, is necessary before forming an opinion. The following questions may here arise:—Was the position such as to be explicable on the supposition of accident? Was it not such a position as might have been given to it by a murderer? Could not the deceased have had strength or presence of mind to escape? Could he have been actually suffocated in the position in which his body was discovered? A little reflection upon the circumstances—for here something more than *medical* circumstance will be required—may enable us to give satisfactory answers to these questions.

A remarkable instance of accidental suffocation was communicated to me by a former pupil, Mr. Rake. A groom was found dead, with his head downward, in the iron rack used for feeding horses with hay. His legs projected from the hole in the floor above. The space was so narrow that there had been no room to turn, and there was no fulcrum by which the deceased, who had thus fallen head downwards into the hole, could again raise himself. There was no doubt that, in reaching into the hole, the deceased had accidentally fallen head-foremost into the rack in the midst of the hay, and he had died in this position, without the power to raise an alarm or to make any successful effort for his extrication. It is possible that homicide might be committed in this manner; but there was no reason to suspect it in this instance. Singular accidents may lead to death by suffocation, in cases in which, unless the collateral circumstances were known, homicide might be inferred. A man was engaged in shooting flour from the upper to the lower part of a granary: he fell through the trapdoor, and a large quantity of flour fell with him and covered him. Nothing was known of the accident, until his dead body was taken out below; it was then found that his mouth and nostrils were completely filled with flour, and that he must have been accidentally suffocated. A policeman running along a road with two companions suddenly stumbled and fell forwards, with his head in the road and his feet and legs on the pathway. As he did not rise his companions went to his assistance and found him insensible. He was taken to St. George's Hospital, and he was then pronounced to be quite dead. On inspection it was found that the glottis (windpipe) was obstructed by three false teeth, which had been only lately put in: this obstruction had led to suffocation and death. Other cases are recorded in which suffocation has been caused by false teeth becoming displaced and falling back into the throat during sleep, in persons who had worn them during the night.

Suicidal suffocation.—As an act of *suicide*, suffocation is extremely rare. It would require a peculiar adaptation of means, and considerable resolution, in order that a person should thus destroy himself. The following case occurred in France some years since:—A woman locked herself in her room with her young child; she placed herself under the bed-clothes, and desired the child to pile the several articles of furniture in the room upon the bed. When the apartment was entered, some hours afterwards, the woman was found dead; she had evidently been suffocated. Had not the child clearly detailed the circumstances, a strong and even a justifiable suspicion of murder might have arisen. In the Registrar-General's return for June 9, 1864, a woman is reported to have destroyed herself by leaning with her mouth against the bed-clothes; she died from suffocation. In the case of a body found with a plaster covering the mouth and nostrils, or the traces of such having been applied, the witness might be asked whether this could have been so placed by the individual himself? No such case is reported to have occurred as an act of suicide, but we are not, therefore, to say it is impossible: all that we are justified in stating is, that it is a highly improbable mode of self-destruction.

Some singular cases are on record, in which persons have wilfully destroyed themselves by blocking up the throat mechanically. An instance of this form of suicide is reported in the 'Edin. Med. and Surg. Jour.' April 1842. A woman confined in prison forced a hard cotton-plug into the back of her throat. The cavities of the chest and abdomen had been already examined, and a medical certificate given that the deceased had died of apoplexy! The body was sent to one of the anatomical schools, and on re-inspection it was accidentally found that the throat was firmly blocked up with a plug of spindle-cotton. A similar case was the subject of an inquest in London, in September 1843. The deceased here had thrust into her throat a large piece of rag, which had been used in applying a lotion. She speedily died suffocated, and after death the rag was found lodged at the back part of the throat. A case occurred at Maidstone in July 1856, in which a man confined as a prisoner in a cell is reported to have committed suicide by suffocation. He was found lying on his face, dead. He had thrown his bed on the floor, filled his nostrils with pieces of rag, his mouth with a handkerchief, and had tied another handkerchief over his mouth, after which he must have thrown himself down upon his face. Some of these cases are likely to be mistaken for apoplexy, and they certainly show the absolute necessity for a careful examination of the mouth and air-passages in every instance of sudden death. (See 'Edin. Med. and Surg. Jour.' vol. 54, p. 149; also 'Med-Chir. Rev.' vol. 28, p. 410.)

Homicidal suffocation.—Homicide by suffocation is not very common, although it is a ready means of perpetrating murder. Hitherto the cases which have come before our courts of law have been those either of infants, of the aged and infirm, or of persons enfeebled by illness. In regard to the latter, the rigorous administration of the law has succeeded in putting a check to this crime; but with respect to children, it probably yet continues. Death by suffocation is most difficult to detect; and, unless the assailant has employed an unnecessary degree of violence, it is probable that the crime may pass altogether unsuspected. One case is elsewhere reported, in which a plug of dough had been forced into the larynx, and had caused death. The case of *Reg.* v. *Heywood* (Lancaster Summer Assizes, 1839) proves how easily defence of apoplexy may be sustained in a case of alleged murder by uffocation.

Homicide by suffocation would not be attempted on healthy adult persons, nless they were in a state of intoxication, and thereby rendered defenceless. is certain that most individuals would have it in their power, unless greatly capacitated by disease or intoxication, to offer such a degree of resistance s would leave upon their bodies indubitable evidence of murderous violence. eath by suffocation may be considered as presumptive of homicide, unless e facts are clearly referable to accident. Accidental suffocation is, however, palpable from the position of the body and other circumstances, that when eath is clearly traced to this cause, it is not easy to conceive a case in which it ould be difficult to distinguish it from one of actual murder. In some in- ances, the very means that have been adopted to produce suffocation may forbid e supposition of accident, and clearly establish the fact of homicide.

M. Devergie has reported a case, in which a man was suffocated by having is face forcibly thrust into a heap of corn. A quantity of the corn was found locking up the mouth and nostrils, and some of the grains had passed into e air-passages (drawn into them by forcible aspiration), as well as into e stomach by swallowing, and even into the duodenum. That violence ad been used, was proved by the marks of indentations produced by the rains of corn on the face, as well as by excoriations (indicative of resistance) n the hands. The facts are quite inconsistent with the supposition of sui- de or accident; yet the jury declined to accept the medical opinion, that e deceased had been homicidally suffocated. ('Ann. d'Hyg.' 1852, vol. 2, 195.) The presence of the grains of corn in the duodenum is not easily be explained, considering the rapidity of death from suffocation, and that ey could not be carried to the small intestine either by aspiration or deglu- tion. The power of aspiration in the chest is exceedingly great (p. 634), nd drunken or helpless persons may, by falling in the midst of dust, ashes, or her substances, easily draw a portion of these substances into the air-passages, nd thus die by suffocation; but this effect of aspiration will not account for e passage of such substances into the stomach and bowels. In the journal bove referred to, M. Devergie mentions the case of a man who fell asleep ear some sheaves of corn. He was found dead, and the cause of death was bviously asphyxia; an ear of corn was found fixed in the air-passages.

The suffocation of new-born children, by the introduction of substances to the mouth, is not unfrequent. (See INFANTICIDE.) The unnecessary force mployed generally leaves traces of violence, which may be easily discovered y a careful examination, even should it happen that the substance used for e murderous purpose has been removed. M. Devergie has suggested an bjection to evidence founded on a fact of this nature, that the substance ight have been introduced after death in order to create a suspicion of fanticide against the mother; but such an objection could hardly be received, nce the fact is only one out of many which would be brought against an cused person. According to Devergie, the appearances produced by the troduction of a plug of linen into the mouth *during life* are these :—The outh contracting posteriorly, the pressure would be greater in this situation; onsequently the blood would be forced out of the compressed mucous mem- rane of the palate. In the fore-part the pressure would be less; and here the lood would accumulate, so that the mucous membrane in this situation would ecome swollen and red. In trusting to these characters, it must be remem- ered that similar appearances would probably result if the plug were intro- uced immediately *after death*, as, also, that even when introduced during fe, the characters might be lost if the plug were removed from the mouth efore the body had entirely cooled.

It is necessary to point out a dangerous practice common among ignorant nurses, which, without exciting suspicion on the part of a coroner or medical witness, may be an occasional cause of death in infants. In order to quiet a child, and to enable a nurse to sleep without disturbance, a bag made of wash-leather or rag, containing sugar, is thrust into the child's mouth. It is thus completely gagged, and the child soon becomes quiet, respiring chiefly through the nostrils. If these by any accident become obstructed, or by the act of respiration the bag should fall to the back of the throat, death by suffocation must inevitably result, the infant being perfectly helpless! The suspension of respiration may be so gradual that the child may die without crying or convulsions. The removal of the bag from the mouth, as no violence had been used, will remove every trace of the cause of death; and, in order to exculpate herself, the guilty person may ascribe death to 'fits.' In one instance, within my knowledge, an infant was timely saved by the mother having discovered, while the nurse was sleeping, a mass of wash-leather projecting from its mouth. The woman awoke, and attempted to remove and conceal the leather, but she was detected in the act. The detection of this dangerous practice can only be a matter of pure accident: hence a fatal case can be rarely the subject of a coroner's inquest, and even then medical evidence may fail to throw any light upon the cause of death. In one instance only have I known it to give rise to a criminal charge—(*Reg.* v. *Cox*, Warwick Lent Assizes, 1848). The mother, a pauper female, was tried for the attempt to suffocate her infant, eleven days old. The child was discovered by another person with a piece of rag hanging from its mouth. It was livid in the face, but when the rag was removed it made a violent gasp, and recovered its breath. There was no malice on the part of the prisoner, but it was made a strong point in her favour that instances had occurred in the workhouse, in which women had with impunity put rags with sugar into the mouths of infants in order to soothe and keep them quiet! The jury acquitted her. The admitted practice of infantile suffocation in the Warwick workhouse appears to have passed without reprimand or even comment, although this plan of soothing infants is just as likely to be fatal to them as that of encircling their necks with tight ligatures.

SMOTHERING.

Smothering is a variety of suffocation, and consists in the mere covering of the mouth and nostrils in any way so as to prevent the free ingress and egress of air. Like drowning, hanging, or strangulation, it produces death by asphyxia. In new-born infants it is not an unusual occurrence, sometimes originating in accident, and at others in criminal design. An infant may be speedily destroyed by smothering. If the mouth be only lightly covered with clothing, or slightly compressed, so that respiration is interrupted, as in the act of carrying a child in the arms, this will suffice to cause death; and, as it has been already remarked, death may take place without being preceded by convulsions or other striking symptoms. Smothering is not often resorted to as a means of perpetrating murder, except in infants, or in debilitated and infirm adults. In a case which occurred at Ayr, a woman was charged with the murder of her child by smothering it in her shawl. She was travelling in a steamboat: it was a cold stormy day, and she had wrapped the shawl closely round the head of the child. There could be no doubt, from the moral circumstances, that she had intended to kill it; but the defence was that she had merely intended to protect the child from the cold, and it was suffocated before she was aware of it. There were no facts to exclude this defence, and the woman was acquitted. I have known an instance in this metropolis in which an infant was unintentionally destroyed by the close wrapping of a shawl round its head. In December 1852 Mr. Thornley of Blyth, Nottinghamshire, consulted me in a case in which an infant was found dead in bed. It was a perfectly healthy child, about three months old. It had been left by the nurse in bed quite well in the morning when she got up. A quarter of an hour afterwards the father went into the room and could not see the child; but on removing the bed-clothes he found it beneath them, quite dead, its head covered completely by six folds of clothes. The body was quite warm (showing recent death), the countenance was calm, the limbs were relaxed: there was a little frothy mucus about the mouth, but nothing to indicate a violent death. There was no doubt, from the circumstances, that the child had been accidentally smothered or suffocated: its body had slipped down beneath the clothes, the mouth and nostrils were covered,—asphyxia speedily came on, and this proved fatal owing to the helplessness of the infant. According to Mr. Wakley, as a result of his experience, infants are frequently found dead owing to their being suckled at night while the woman is in bed. The child's face is pressed on the breast; mother and child fall fast asleep; the head slips beneath the clothes, and the child is then quietly suffocated. There is no mark of pressure on the body. ('Lancet,' Jan. 16, 1858, p. 69.) A case, apparently of this kind, was communicated to me by Mr. Nason in Sept. 1860. The child (five days old) died quietly on its mother's arm while lying in bed. There was much lividity about the head, neck, and back; but there were no marks of violence. The bronchial tubes of the right lung contained bright florid blood. The left lung was gorged with blood, but none had escaped. The heart was firmly contracted, and there was only a small quantity of blood in its right cavities.

In the Registrar-General's Weekly Return for London, for the 18th January 1862, there were twelve deaths from suffocation: eleven of these were among infants. In one district of Whitechapel there were three deaths of children from suffocation in bed. In a return of inquests held in Liverpool in 1864, it appeared that out of 960 inquests there were 143 on infants and children who had been suffocated, chiefly between the Saturday and Monday of each week.

In November 1848 Mr. Canton communicated to the Westminster Medical Society an account of the appearances met with in the examination of the bodies of three children, each only a few months old: two of these children had been 'overlain,' and the third had been intentionally suffocated.—*Externally:* features placid; lips congested; eyes not unduly prominent; conjunctivæ rather reddened; hands clenched; no patches of ecchymosis to be anywhere detected.—*Internally. Head:* patches of effused blood, here and there beneath the pericranium; cranial bone engorged with blood. In two cases great congestion of the pia mater, accompanied by numberless effusions of blood, varying in size from a pin's point to a silver penny in superficial extent: no such effusion within the brain or its contained membranes: a little clear fluid in the ventricles. In the third case the appearances in the head were natural, whilst those of the skull-bones and pericranium were the same as in the other cases: a little clear frothy mucus in the windpipe and bronchi, with redness of their lining-membrane.—*Chest:* the lungs were much congested and crepitant, whilst beneath the pleuræ blood had been everywhere effused, presenting numerous small bright-red patches, and fine points; all the blood of the substance of the lungs was within its vessels. The pericardium contained some serum, and was spotted in its whole extent after the manner described; the vasa vasorum of the heart's great vessels and thoracic aorta were minutely injected. In one case there was a large quantity of blood effused posteriorly, and especially on the left side, in the groove between the auricles and ventricles, as though the coronary vein had been ruptured; this latter point, however, was not ascertained. In this instance, too, the substance of the heart, particularly its left ventricle, was so soft as to become readily pulpy on slight pressure between the finger and thumb. The right cavities in all the cases contained dark liquid blood; the left cavities were nearly empty; the tissue of the organ was free from effusion of blood. The surface only of the thymus-gland was mottled like the heart. There was no unnatural appearance within the abdomen.

Certain trials which took place some years since clearly proved that persons in a state of intoxication or infirmity had been murdered by smothering, for the sake of the money derived from the sale of the dead bodies! It will be sufficient to mention the trials of *Burke* and *Macdougall* in Edinburgh, and of *Bishop* and *Williams* in this metropolis, as affording ample evidence of the past existence of this horrible system of secret murder. (See 'Ed. Med. and Surg. Jour.,' April 1829, p. 236.) The victims were commonly destroyed by the assailant resting with his whole weight upon the chest, so as to prevent the motion of the ribs, and at the same time forcibly compressing the mouth and nostrils with his hands, to prevent the entrance of air. A case of this kind was referred to me for examination in 1831. (*Rex* v. *Elizabeth Ross*, Old Bailey Sessions, Dec. 1831, see page 104.) It was remarkable for the fact that the prisoner was convicted of homicidal suffocation, although the body of the deceased was never discovered. ('Med. Gaz.,' vol. 37, p. 451.) In Nov. 1844 a man was convicted at the Assizes of the Seine of the murder of a woman by placing a pitch-plaster over her face. A trial for murder by smothering took place at the Lincoln Lent Assizes, 1843. (*The Queen* v. *Johnson.*) The prisoner, while committing a burglary, tied the deceased to a bed, so that she could not move, and then tucked the clothes closely over her head: after remaining some hours in this condition the deceased died. The prisoner was convicted and executed. For an important case, involving the question of death from homicidal smothering, or from apoplexy, see that of *the Queen* v. *Heywood.* (Lancaster Summer Assizes, 1839.) As an accident, smothering may be conceived to take place when a person falls, in a state of intoxication and debility, so that his mouth is in any way covered, or the access of air to the mouth or nostrils is interrupted. On an inspection of the body the appearances elsewhere described (p. 698) will be met with in the lungs and heart. If the person has been able to struggle, it is probable that some marks of violence in the shape of scratches or bruises may be found about the mouth and nostrils, with bruises or marks of pressure on the chest, legs, or arms, and a bloody mucous froth in the air-passages. The marks of violence may be slight, or even entirely absent. In a case of suspected murder a medical jurist should look for the special indications of suffocation in the lungs, the circumstances under which the body or bodies are found, the evidence of sudden death in the presence of food in the stomach, and, lastly, the absence of any other cause to account for death. All these sources of evidence may fail; and as the means by which homicidal smothering was accomplished are not likely to be found with the body, a medical opinion on the case may become little more than a conjecture. Still this may suffice when the evidence from extraneous circumstances is strong.

A remarkable case, involving the proofs of this mode of death in reference to three children, was referred to me for examination by the Home Office in May 1862. A man and his wife of the name of *Taylor*, living at Manchester, were charged with the murder of a Mr. *Meller*, and on searching their house their three children were found lying dead on the floor of a bedroom side by side. They were of the ages of twelve, eight, and five years—two girls and a boy. One of them had been seen alive on Wednesday, May 14, and their dead bodies were first discovered early on Friday morning, May 16.

The children had on their nightdresses; the bodies had been carefully laid out—the arms by their sides. There was no rigidity, but the skin of the abdomen had a slightly greenish colour. In the opinion of those who first saw the bodies the children had been dead from one to two days.

The body of the eldest girl, æt. 12, presented no mark of violence around the neck indicative of strangulation. There was a slight bruise or scratch over the bridge of the nose, which had been produced during life. The surface of the brain was slightly congested. The lungs were of a reddish colour, full of air and not congested. The heart was natural, and the ventricles contained some fluid blood. In the stomach were four ounces of a fluid resembling barley-water, without colour, smell, or any other appearance to indicate the presence of a liquid or solid poison. There was no blood, and no undue secretion of mucus; the mucous membrane was pale. All the viscera were healthy, and revealed no cause of sudden death in any part. On the body of the second girl, æt. 8, a slight bruise was observed over the left eye, and another bruise over the shin-bone of one leg. The body of the boy, æt. 5, presented no mark of violence externally. In two of the children the pupils were dilated. Internally the appearances were similar to those found in the eldest girl. All the organs were healthy, and there was no apparent cause for death. The back of the throat and air-passages presented no obstruction from mechanical causes. The conclusions arrived at by the medical gentlemen were—1st, that these children had not died from any natural cause; and 2ndly, that they had not died from wounds, drowning, hanging, strangulation, starvation, or any of the ordinary causes of violent death.

No trace of poison, by odour or otherwise, was found on examination of the stomachs and their contents. Portions of the intestines and contents, with some of the viscera from the bodies of two of the children, were sent to me. I found these parts healthy, containing fæces, and free from any indication of the presence or action of any poison. Poisoning, which was at first suspected, appeared to be completely negatived by the circumstances. The children had died suddenly, at about the same time, and most probably from a similar cause. Only a powerful poison, in a strong dose, would be consistent with this state of facts. Such a poison would have been detected either in the stomach or bowels, by colour, smell, or the application of the usual tests. There had been no vomiting, and the poison had not passed off by the bowels; hence the case was most favourable for the detection of poison if it had been present. No poison could be traced to the possession of the accused.

It was suggested that the children had been killed by charcoal-vapour or coal-gas, but this suggestion was not supported either by the appearances in the bodies, or by any of the circumstances of the case. Two sponges were found in the room in a wet state, and it was supposed that they had been used for applying the vapour of chloroform. Although this mode of death would leave no evidence after two or three days, yet it was considered improbable that such persons as the prisoners would have the knowledge to use chloroform, and none of this liquid could be traced to their possession. I examined the sponges for chloroform, and there was no trace of it. As there was nothing medically inconsistent with death from chloroform-vapour it was not excluded under the circumstances; but on a consideration of the state of the bodies, and the whole of the facts proved, the conclusions which I drew, and which formed the basis of my evidence at the magisterial investigation, were—1. That these children died suddenly, and probably about the same time, from a similar cause; 2. That they did not die from any natural cause; 3. That they died either from suffocation as a result of smothering, or from the effects of chloroform-vapour.

No natural cause for sudden death could be suggested,—not to mention the extreme improbability that three healthy children, well supplied with food, should die simultaneously from any natural cause, of which no trace could be found in their bodies. If we except the act of suffocation by smothering, no cause of violent death could be suggested. It is highly probable that these children were smothered while in bed on the night of Wednesday the 14th. The state of the lungs and heart was consistent with this mode of death. The peculiar dotted appearance of the surface of the lungs, described by Tardieu (p. 698), if present, escaped the notice of the inspectors. There was a mark indicative of violence on the face of the eldest, and a bruise on the face as well as on the shin of the second girl,—the two who were strongest, and therefore most capable of resisting. These marks, although slight, clearly indicated violence during life. The whole of the moral circumstances, including the writing on papers found pinned to the dead bodies, tended to show that three murders had been deliberately perpetrated, and no more probable cause of death could be suggested than that of suffocation by smothering. The medical gentlemen who made the inspection considered that suffocation was not the cause of death, because 'there was no appearance of congestion about the lungs.' Some remarks on this post-mortem appearance have been made elsewhere (p. 698); and it is desirable, in reference to future cases, to point out the fallacy involved in the assumption that congestion of the lungs is necessarily present in this kind of violent death. Mr. Watson observes that the gorged state of the right side of the heart and lungs is greatest where the act of suffocation (asphyxia) has been slow and gradual, by the access of air to the lungs not having been completely prevented. When, on the other hand, death has taken place quickly and suddenly from this cause, there is little or no unusual congestion of blood in the lungs or heart. ('On Homicide,' p. 115.) At page 118 he describes a case of death from suffocation in which the lungs were natural; and in the case of *Campbell*, for whose murder by suffocation *Burke* was convicted and executed in 1828-9, Dr. Christison and Mr. Newbigging found the organs within the chest perfectly natural, the lungs remarkably so, and unusually free from infiltration. The blood in the heart and great vessels as well as throughout the body was fluid and black. ('Ed. Med. and Surg. Jour.,' vol. 31, p. 239.) Again, in the case of *Carlo Ferrari*, for the murder of whom *Bishop* and *Williams* were convicted and executed in London in 1831, the lungs were quite healthy and *not congested*; the heart was rather small, contracted, and its four cavities perfectly empty. (Taylor's 'Elements of Medical Jurisprudence,' 1836, p. 292.) The prisoners in this case confessed that they destroyed the deceased by suffocation. From these facts it will be perceived that the actual state of the lungs and heart in the bodies of those who had been notoriously murdered by suffocation, was considered thirty years afterwards, *i.e.* in these Manchester cases, to be inconsistent with death by this form of suffocation.

In reference to the case of *Campbell*, Dr. Christison observes, 'that the conviction in the public mind that a well-informed medical man should always be able to detect death by suffocation simply by an inspection of the body and without a knowledge of collateral circumstances is erroneous, and may have the pernicious tendency of throwing inspectors off their guard, by leading them to expect strongly-marked appearances in every case of death from suffocation. That such appearances are very far from being always present ought to be distinctly understood by every medical man who is required to inspect a body and give an opinion of the cause of death.' (Op. cit. p. 243). At the same time, in the absence of marked appearances to indicate violent death, due caution should be used by a medical witness in expressing an opinion. At the trial of the prisoner *Burke*, Dr. Christison restricted his opinion by stating that death by violence was, from the medical circumstances alone, *very probable*,—a degree of caution which on similar occasions it will be desirable for a medical witness to imitate. Under the rule of English jurisprudence, by which accused persons are not allowed to be interrogated, it is not possible to carry medical evidence further than this. There is nothing in the act of suffocation, as there is in wounds, poisoning, hanging, or strangulation, by which the hand of a criminal can be clearly and unequivocally traced.

CHAPTER 55.

GASEOUS POISONS—CAUSE OF DEATH MISTAKEN—CARBONIC ACID—MODE OF ACTION —SYMPTOMS—APPEARANCES—ANALYSIS—CHARCOAL-VAPOUR—ITS EFFECTS—CARBONIC OXIDE—COAL AND COKE VAPOUR—SULPHUROUS ACID—VAPOUR OF LIME, CEMENT, AND BRICK-KILNS—CONFINED AIR—COAL-GAS—CARBURETTED HYDROGEN.

Mode of action of gaseous poisons.—In following common language, a medical jurist is compelled to apply the term suffocation to another variety of death—viz., to that of poisoning by *gases*. Physiological accuracy must here be sacrificed, in order that we may make ourselves generally intelligible. Thus, if a person die from the effects of carbonic acid, of confined air, of sulphuretted hydrogen, or of other noxious gases, he is commonly said to die suffocated. Strictly speaking, he dies poisoned—as much so as if he had taken oxalic or hydrocyanic acid. The only differences are:—1. That the poison, instead of being liquid or solid, is *gaseous*; and 2. Instead of being applied to the mucous membrane of the stomach, it affects that of the *air-cells* of the lungs. In the action of arseniuretted hydrogen we have a clear instance of poisoning by a gas, and in the respiration of the narcotic vapours of chloroform and ether we have also illustrations of this form of poisoning. Owing to the fact that the poisonous material is in a finely-divided state, and that in the air-cells of the lungs it meets at once with a large absorbing surface, and instantly enters the blood, the effects are more rapid and, *cæteris paribus*, more powerful. It has been remarked, too, that some (and probably all) of these aerial poisons have an accumulative action—*i.e.*, their effects continue to increase for a short period, even after a person has ceased to respire them.

The cause of death mistaken.—The greater number of the poisonous gases are chiefly complex products of art, and are never likely to be met with in the atmosphere so abundantly as to produce injurious consequences; hence fatal accidents, arising from their inhalation, most commonly occur under circumstances which can leave no question respecting the real cause of death. The peculiar effects of all of these it will not be necessary to describe in this place; but there are two a knowledge of the properties and operations of which may, on certain occasions, be required of a medical jurist: these are the CARBONIC ACID and SULPHURETTED HYDROGEN GASES. Agents of this description can rarely be employed with any certainty as instruments of murder; and if they were so employed, the fact could be established only by circumstantial evidence. One alleged instance of murder by carbonic acid is, however, reported by M. Devergie. ('Ann. d'Hyg.,' 1837, vol. 1, p. 201.) Death, when arising from the respiration of any of the gases, is generally attributable to suicide or accident. In France it is by no means uncommon for a person to commit self-destruction by sleeping in a closed apartment, in which charcoal has been suffered to burn; while in England accidental deaths are sometimes heard of, where coal or coke has been employed as fuel in small and ill-ventilated rooms. On such occasions a person may be found dead without any apparent cause to the casual observer; the face may appear pale or livid, and the skin may be covered with patches of lividity. The discovery of a body under these circumstances will commonly be sufficient, in the eyes of the vulgar, to create a suspicion of murder; and some person, with whom the deceased may have been at that period on bad terms, will perhaps be pointed out as the murderer. In such a case, it is obvious that the establishment of the innocence of the accused will depend entirely on the discrimination and judgment of a medical practitioner. An instance, illustrative of the consequences of this popular prejudice, occurred in London in 1823. Six persons were lodging in the same apartment, where they were all in the habit of sleeping. One morning an alarm was given by one of them, a female, who stated that on rising she found her companions dead. Four were discovered to be really dead, but the fifth, a married man, whose wife was one of the victims, was recovering. He was known to have been on intimate terms with the female who gave the alarm, and it was immediately supposed that they had conspired together to destroy the whole party, in order to get rid of the wife. The woman who was accused of the crime was imprisoned, and an account of the supposed barbarous murder was soon printed and circulated in the metropolis. Many articles of food about the house were analysed, in order to discover whether they contained poison, when the circumstances were explained by the man stating that he had placed a pan of burning coals between the two beds before going to sleep, and that the doors and windows of the apartment were closed. (Christison, p. 583.) A set of cases of a similar kind, in which there was at first a strong suspicion of poisoning, has been reported in the 'Medical Gazette,' by Mr. Smith, of Liverpool (vol. 36, p. 937; see also 'Ann. d'Hyg.,' 1843, vol. 2, p. 56).

CARBONIC ACID.

This gas is freely liberated in respiration, combustion, and fermentation; it is also produced in the calcination of chalk or limestone, and is sometimes diffused through the shafts and galleries of coal-mines, where it is commonly called 'choke-damp.' Carbonic-acid gas is likewise met with in wells, cellars, and other excavations in the earth. In these cases it is generally found most abundantly on the soil, or at the lower part of the well; and it appears to proceed from the decomposition of animal and vegetable matters confined in such situations. The slow evaporation of water strongly charged with the gas, while trickling over the sides of these excavations, may likewise assist in contaminating the air. Damp sawdust or straw slowly absorbs oxygen from a confined atmosphere, and sets free carbonic acid.

Action on the body. Fatal proportions.—Sir Humphry Davy believed that carbonic acid, in a perfectly pure state, did not pass into the trachea when an attempt was made to respire it; the glottis seemed to close spasmodically at the moment that the gas came in contact with it. On diluting the carbonic acid with about twice its volume of air, he found that he could breathe it; but it soon produced symptoms of giddiness and somnolency. In a diluted state there is no doubt that it penetrates into the lungs, and that it is absorbed and circulated with the blood. M. Collard de Martigny found that a mixture of carbonic acid and oxygen, in atmospheric proportions, produced rapidly fatal effects upon the animal system. Such a mixture cannot be breathed even for a period of two minutes, without giving rise to serious symptoms. This proves that dilution with a normal proportion of oxygen does not prevent its poisonous effects. The specific action of this gas on the brain may be inferred from the headache, giddiness, somnolency, and insensibility, as well as from the loss of muscular power observed in persons labouring under its effects, and the paralysis which is sometimes seen in those who have recovered.

In reference to this question, it is absolutely necessary to make a distinction between the contamination of air by the addition of a proportion of free carbonic acid, and the case where this gas is produced by combustion or respiration in a close apartment at the expense of the oxygen actually contained in air. Every volume of carbonic acid formed by combustion indicates an equal volume of oxygen removed. Such an atmosphere is, *cæteris paribus*, more destructive than another where the air and gas are in simple admixture. If we assume that in each case the noxious atmosphere contains 10 per cent. of carbonic acid, then in one instance there will be 7 per cent. more of oxygen and 7 per cent. less of nitrogen than in the other, since the production of 10 parts of carbonic acid as a result of combustion implies the loss of 10 parts of oxygen. This difference in the proportions may not be, practically speaking, correct, because there is no apartment sufficiently closed to prevent air rushing in from the exterior while combustion is going on within it; but, nevertheless, the above statement may be taken as an approximation to the truth. When the gas is respired in its lowest poisonous proportion, the symptoms come on more slowly and the transition from life to death is frequently tranquil; this is what we learn from the histories of suicides. The symptoms in such cases appear to resemble closely those which indicate the progressive influence of opium or any other narcotic poison on the body.

Symptoms.—The symptoms of poisoning by carbonic acid vary according to the degree of concentration in which it is present in the atmosphere respired. When it exists in a fatal proportion the symptoms commonly observed are as follows:—A sensation of great weight in the head, a sense of pressure in the temples, a ringing in the ears, with a pungent sensation in the nose; a strong tendency to sleep, accompanied by giddiness, and so great a loss of muscular power that, if the person be at the time in an erect posture, he instantly falls to the ground as if struck. The breathing, which is observed to be at first difficult and stertorous (snoring), becomes suspended. The action of the heart, which on the first accession of the symptoms is very violent, soon ceases: sensibility is lost, and the person now falls into a profound coma, or state of apparent death. The warmth of the body still continues: the limbs are relaxed and flexible, but they have been observed in some instances to become rigid, or even occasionally convulsed. The countenance is livid or of a leaden colour, especially about the eyelids and lips, but on some occasions it has been pale and placid. The access of these symptoms is stated to have been sometimes accompanied by a pleasing sensation of delirium, while at others the most acute pains have been suffered. In some instances there appears to have been irritability of the stomach, for the affected person has vomited the contents of his stomach in a semi-digested state. Those who have been resuscitated, have felt pain in the head, or pain and soreness over the body for several days; while, in a few severe cases, paralysis of the muscles of the face has supervened on recovery.

The statements made by chemists and physiologists, respecting the proportions of carbonic acid in air required to produce noxious or fatal effects on human beings, are very conflicting. Small animals, such as birds and mice, have been generally made the subject of experiments, but the results thus obtained cannot be satisfactorily applied to show the relative action of carbonic acid on man. Berzelius long ago stated that in a proportion of 5 per cent. in air it was not injurious, and that such a mixture might be usefully employed in the treatment of consumption. ('Traité de Chimie,' t. 2,

p. 83.) Allen and Pepys inferred, from their experiments on guinea-pigs, that 10 per cent. of the gas would prove fatal to man. In the more recent experiments of Bernard this inference is corroborated by the fact that a bird died in two-and-a-half hours in an atmosphere consisting (in 100 parts) of 9·5 of carbonic acid, 28 of oxygen, and 62·5 of nitrogen. ('Les Substances Toxiques,' 1857, p. 135.) In this case the proportion was less than 10 per cent., while the proportion of oxygen was 7 per cent. more than that existing in the atmosphere. Regnault states that carbonic acid does not act deleteriously upon the body; for it may exist in considerable (?) proportions in air without producing much inconvenience to animals, provided the quantity of oxygen is sufficient to maintain respiration. ('Cours Élémentaire de Chimie,' 3rd ed., t. 1, p. 355.) This statement is, however, not in accordance with the above-mentioned experiment of Bernard, or with the experiments of Rolandi and Collard de Martigny. The latter have shown that an atmosphere in which carbonic acid is substituted for nitrogen—the oxygen remaining the same—is fatal to animal life. It is certainly a matter of simple demonstration that such a mixture will not maintain oxycombustion for one instant; and animals do not commonly live in gaseous mixtures which will not support combustion. M. Leblanc placed in a close space a dog, a guinea-pig, a bird, and a frog. Carbonic acid was then allowed to flow in at the top of the receiver, and was diffused as it entered. In seven minutes the dog appeared uneasy; in three-quarters of an hour the dog and the bird were dying, and the body of the frog was swollen. At this time the air was composed of 30·4 parts of carbonic acid and 69·6 of atmospheric air. M. Guérard, who records this experiment, states that he has satisfied himself of the comparative innoxiousness of carbonic acid,—as he breathed without inconvenience air mixed with a large proportion of this gas, derived from the sudden expansion of the liquefied acid. ('Ann. d'Hyg.,' 1843, t. 2, p. 55.) The proportion, however, which he actually breathed under these circumstances is conjectural, and was probably small. His opinion is that carbonic acid is rendered more fatal by the presence of carbonic oxide, and that a quantity of each, which if respired alone would be innocuous, may become fatal to life if respired in mixture (loc. cit.). Bernard affirms that carbonic acid is not poisonous, because no injurious symptoms followed when it was injected under the skin or into the blood of an animal. When an animal dies from breathing this gas its death is, according to him, owing to the mere want of respirable air; hence he considers its action, like that of nitrogen and hydrogen, to be purely negative—in short, that it operates not by poisoning but by inducing suffocation. ('Les Substances Toxiques,' p. 137.) Nevertheless, it was found to differ from these two gases in its great solubility, so that it readily entered the blood, and was diffused with it. But M. Bernard's own experiments prove that carbonic acid destroys life under circumstances in which hydrogen and nitrogen do not. A bird placed in a mixture composed of 50 parts of nitrogen and 50 parts of oxygen breathed it without inconvenience: another bird placed in a mixture of 50 parts of carbonic acid and 50 parts of oxygen died instantly. Although the proportion of oxygen in the two experiments was more than twice as great as that contained in atmospheric air, the animal perished in the mixture of carbonic acid as rapidly as if no oxygen had been present. This result is wholly inconsistent with the assertion of Regnault that it can be breathed with impunity, provided there is sufficient oxygen to maintain respiration. M. Bernard's theory of the operation of carbonic acid when respired, is that, its solubility being greater than that of oxygen, it tends to penetrate the blood in preference to this gas; but as the blood reaching the lungs already contains carbonic acid, this cannot pass by exosmosis into such a mixture. Hence the blood circulates in its unchanged condition, and the animal dies from privation of oxygen. If this view were correct, there appears to be no reason why the more soluble carbonic acid should ever leave the blood, as in ordinary respiration, to replace the insoluble oxygen. The mode of operation here assigned to carbonic acid is of more interest in a physiological than in a medico-legal view. It is enough for a medical jurist to say that carbonic acid when breathed destroys life, even although a normal proportion of oxygen may be mixed with it. A human being dies, according to Bernard, not from the carbonic acid breathed acting directly as a poison, but from the effect of that which is already accumulated in the blood and circulated with it, although how this operates otherwise than as a poison to the body, he does not suggest. In his view it clearly enters the blood when air containing it is respired. He found that before the stage of asphyxia, the blood of an animal contained 2·88 per cent., while, after asphyxia was induced, the proportion of carbonic acid amounted to 4·55 per cent.: this difference, assuming the experiments to be correct, must be regarded as the fatal proportion. (Op. cit., p. 218.) These facts have an important bearing upon the cause of death when human beings perish in a confined atmosphere, in which carbonic acid necessarily accumulates as a result of continued respiration. Bernard's experiments show that no amount of oxygen or pure air will prevent an animal from perishing, provided the carbonic acid is in such quantity as to prevent the escape of this gas from the blood.

I am informed that Dr. Simpson of Edinburgh has employed carbonic acid as an anæsthetic in the proportion of 20 per cent. with air, and that no ill-effects were produced. Such an atmosphere would be composed, in 100 parts, of 20 of carbonic acid, 16 of oxygen, and 64 of nitrogen. In this mixture, if carefully made, oxycombustion cannot be maintained, and thus, assuming Dr. Simpson's experiments to be correct, a man may breathe with safety and live in air in which a candle will not burn! On the other hand, Bernard's experiments prove that although in the enclosed spaces in which animals actually died, the proportions of oxygen varied from 3 and 5 to even 39 per cent., the proportion of carbonic acid never exceeded from 12 to 18 per cent. ('Les Substances Toxiques,' p. 140.) It is obvious that before inferences can be fairly drawn from experiments on human beings, there should be not only great accuracy in measuring proportions, but the lungs of the person should be completely emptied before the mixture of carbonic acid and air is introduced; and the mouth and nostrils should be completely closed except where the tube enters. Unless these precautions are observed, great fallacies must arise in the performance of such experiments. If such a mixture is loosely breathed like an anæsthetic vapour, so that air can at the same time freely enter the lungs, the proportion of carbonic acid which is actually taken into the air-cells must be a mere matter of conjecture. These circumstances may account for the conflicting results obtained—that human beings may breathe 20 per cent. of the gas without danger, while animals perished from breathing mixtures in which the gas never exceeded 18 per cent.!

It is a question whether time may not compensate for quantity. A proportion of 5 per cent. produces no immediate evil effects; but could such a mixture support life like the normal atmosphere, which contains only from 1-2000th to 1-2500th part by volume? In the deep Cornish mines I have found the air to contain two per cent. of carbonic acid, which is forty times greater than the atmospheric proportion. The miners suffer seriously in health; and, admitting that other influences are at work to account for this, a gas which operates by stopping the oxidation-changes of the blood would be likely to produce in time noxious effects on the body. The fatal proportion in all ordinary cases may be taken at from 10 to 20 per cent., and even less when the carbonic acid has been produced at the expense of the oxygen contained in an enclosed space.

Appearances after death.—The body of a person who has perished from the inhalation of carbonic acid is said to retain the animal heat, *cæteris paribus*, for a longer period than usual; and hence, according to Orfila, cadaveric rigidity does not commonly manifest itself until after the lapse of many hours. In a case to be related presently the body was, however, found to have cooled considerably within the short space of two hours. There is no reason to believe that this mode of death affects the rate of cooling or the access of rigidity. In some instances it is said the face has been found livid and swollen and the features distorted, but more generally it has been pale and placid, as if the persons had died without a struggle in the position in which their bodies were found. The skin is sometimes livid, or presents patches of lividity, and the limbs are quite flaccid. The pupils have been found dilated. *Internally*, the venous system is found filled with liquid blood of a dark colour. In death from carbonic acid as a result of combustion, the blood has sometimes had a light-red colour. The vessels of the lungs and brain are observed to be especially in a state of congestion. The tongue appears swollen, and it is stated by Orfila that the mucous membrane of the intestinal canal is often interspersed with dark ecchymosed patches. The following appearances were met with thirty hours after death in the bodies of two adults, male and female, who died from the accidental introduction of carbonic acid into their bedroom from burning ashes. Externally there was nothing unnatural, excepting a few slight discolourations on the back of the man; internally there was congestion of the membranes and great vessels of the brain. Each lateral ventricle contained about half-an-ounce of clear serum: the lungs were gorged with dark blood: and the lining-membrane of the air-tubes (bronchi) was slightly reddened. The left sides of the heart were nearly empty: the right contained a quantity of dark half-coagulated blood. The stomachs were healthy. The bodies were found on the floor of the bedroom in easy positions. The deceased persons had had the power to get out of bed, but were unable to escape from the chamber. It will be perceived from this description that there is nothing very characteristic in the appearances, and thus it is always easy to ascribe death to apoplexy or some other cause; but it should be remembered that carbonic acid itself is a narcotic poison, inducing cerebral congestion and apoplexy.

The following singular case of death from carbonic acid was communicated to me by Mr. Procter of York. The deceased, an old woman, occupied a room under one in which there was a quantity of nitric acid kept in store. Owing to some accident a carboy was broken: the acid ran through the ceiling into the room below, acting upon and corroding the bed-coverings of the deceased's bed. As the room was quite filled with the nitric-acid fumes, a chemist was consulted, and he advised that whiting should be freely used for the purpose of neutralizing the acid. This advice was followed, and several persons, who were in the room witnessing the operation, felt oppressed and were obliged to leave it: they were observed to stagger, as if intoxicated, on reaching the street. The room was then completely closed, and the whiting allowed to remain in contact with the acid. The deceased had suffered from diarrhœa for a few days previously, and was obliged to resort to the night-chair, which was in the room in which the accident had occurred. As she remained absent half-an-hour, some persons entered the apartment, and found her in the chair unable to move. She was taken into another room, and on a medical man being called to her, he found her sleepy and comatose—her mind confused: there was great difficulty of breathing,—extreme lividity of the face and lips: the arms and legs were cold, and the pulse was full. In spite of efforts made to save her, she died in about an hour from the time at which she had entered the room. Those who found her in the apartment do not appear to have suffered. This was a case of slow poisoning by carbonic acid, for no carbonic oxide could have been evolved from the action of the acid on the chalk. Age and debility from previous illness may account for the unusual circumstance that the deceased did not recover on being removed to a pure atmosphere. In March 1863 a boy mounted on a forty-barrel vat, and while looking through the man-hole fell among some wet hops, and speedily died from respiring the atmosphere of carbonic acid. Two men successively endeavoured to rescue the boy, but each died in the attempt. In the same year a man at Bromley descended into a large vat, having previously applied the candle test. He was heard to cry out 'There is gas here,' and he instantly fell back dead: he had probably stirred up the contents after he had lowered the candle. ('Lancet,' Nov. 12, 1864, p. 552). Many other cases of a similar kind are reported. Under these circumstances the noxious agent is pure carbonic acid more or less mixed with air.

Analysis.—Sometimes a medical jurist may be required to state, for the purposes of justice, the nature of the gaseous mixture in which a person may have died. He will have but little difficulty in determining whether carbonic acid is or is not the deleterious agent in such a mixture. When it exists in a confined atmosphere its presence may be identified, if previously collected in a proper vessel, by the following characters:—1. It extinguishes a taper if the proportion be above 12 or 15 per cent.; and, from the extreme density of the gas, the smoke of the extinguished taper may be commonly seen to float on its surface. 2. Lime-water, or a solution of subacetate of lead, is instantly precipitated white when poured into a jar of the gas; and the precipitate thus formed may be collected by filtration, and proved to possess the well-known properties of carbonate of lime or lead. Air containing only 1 per cent. of carbonic acid affects lime-water: if it amounts to 2 per cent. a few cubic inches will suffice to show its presence by the lime-water test. The *proportion* in which carbonic acid exists in a mixture may be determined by introducing into a measured quantity, in a graduated tube over mercury, a strong solution of potash. Absorption will take place after a certain time, and the degree of absorption will indicate the proportion of carbonic acid present. When this gas exists in a confined spot, as in a well or cellar, it may be generally got rid of by placing within the stratum a pan containing the hydrate of lime, loosely mixed into a paste with water; by exciting combustion at the mouth of the pit; or, what is better when available, by a jet of high-pressure steam. Lives are often successively lost on these occasions, in consequence of one person descending after another, in the foolish expectation of at least being able to attach a rope to the body of his companion. The moment that the mouth comes within the level of the invisible stratum of gas all power is lost, and the person commonly sinks lifeless. Carbonic acid may be collected for the purpose of testing by lowering a bottle filled with fine sand, by means of a string attached to the neck, and guiding the bottle by another string attached to its base. When the bottle is within the stratum, it should be turned with its mouth downwards; and when the sand has fallen out, it may be rapidly raised, with its mouth upwards, by pulling the string attached to the neck.

CHARCOAL-VAPOUR. CARBONIC OXIDE.

The vapour extricated during the combustion of charcoal is not pure carbonic acid, but a mixture of gases. It operates fatally when respired, partly in consequence of the carbonic acid contained in it, and partly from the presence of a variable proportion of carbonic oxide. The proportion of these gases, however, is subject to variation, according to whether the combustion is vivid or not. When the charcoal burns vividly, the quantity of carbonic acid was found by Orfila to be less than when it is either nearly extinguished or beginning to burn. In the former case the carbonic acid was in the proportion of about 11 per cent. by volume—in the latter the proportion amounted to about 14 per cent. Leblanc found that charcoal burning in the open air produced about $\frac{1}{2}$ per cent. of carbonic oxide. There is no doubt that a low or imperfect combustion is more favourable to the production of this gas, and it is considered to operate more powerfully on the body than carbonic acid. According to Leblanc a bird was killed instantly by breathing an air containing only 4 or 5 per cent. of carbonic oxide; only 1 per cent. sufficed to cause death in two minutes. ('Ann. d'Hyg.' 1843, vol. 2, p. 54). Charcoal-vapour may be regarded as a mixture of carbonic acid, carbonic oxide, aqueous vapour, and air partially deoxidized. There is also associated with it, at a low temperature, a small quantity of carburetted hydrogen. This does not appear to take any part in the fatal effects produced by the vapour: these are owing to the action of carbonic acid and carbonic oxide, and according to Bernard a mixture of the two is more destructive than either gas separately. ('Les Substances Toxiques,' p. 212). M. Leblanc endeavoured to determine the proportion of the gases in charcoal-vapour when this was in such a condition as to prove fatal to animal life. The vapour was conducted from some fully-ignited fuel into an enclosed space in which there was a middle-sized dog whose condition could be watched. In ten minutes the animal fell exhausted, and in twenty minutes it died, after some hard breathing. A candle burnt with its usual brightness in the closed room, and it was only ten minutes after the death of the dog that the flame of the candle, from becoming paler and paler, was extinguished. The air of the chamber was at this time collected and analysed: it contained, in 100 parts—carbonic acid, 4·61; carbonic oxide, 0·54; carburetted hydrogen, 0·04; oxygen, 19·19; and nitrogen, 75·62. It would thus appear that less than 5 per cent. of carbonic acid is fatal to life when so little as $\frac{1}{2}$ per cent. of carbonic oxide is mixed with it. (Bernard, op. cit., p. 159). The burning of a candle under the circumstances will also show that oxycombustion may be maintained in a mixture by which an animal is killed, and therefore that combustion can furnish no criterion of safety in apartments in which charcoal has been burnt.

Symptoms and appearances after death.—The following case, illustrating the effects of charcoal-vapour, occurred to Mr. Collambell. ('Med. Gaz.' Vol. 27, p. 693.) In January 1841 a man was engaged to clean the windows of three small rooms on the basement-floor of a house. The first room had a door opening into a court-yard; the others merely communicated with each other by a central door, and there was no fireplace in any one of them. A brazier of burning charcoal had been placed in the outer room for the purpose of drying it, but it appeared that the deceased had shut the outer door, and had removed the brazier into the inner room of the three, leaving the communicating doors open. In *two hours* the man was found quite dead, lying on the floor of the middle room. The countenance was pale, as well as the whole of the skin: the eyes were bright and staring, the pupils widely dilated, the lips bloodless, the jaws firmly fixed, the tongue protruding; and the face and the limbs were cold. Some frothy mucus had escaped from the mouth. The person who discovered the deceased, found the ashes in the brazier still burning, and he experienced great oppression in breathing. An inquest was held, but without an inspection of the body, and a verdict of 'accidental death' returned. The body was afterwards privately inspected by Mr. Collambell. On opening the head the vessels on the surface of the brain were found much distended with dark liquid blood; the pia mater was bedewed with serum. The brain was of unusually firm consistency, and numerous bloody points appeared on making a section of it. The lateral ventricles were distended with about an ounce and a half of pale serum, and the vessels of the plexus choroides were much congested. The cerebellum was firm, and presented on section numerous bloody points. About two ounces of serum, tinged with blood, were collected from the base of the skull. The lungs had a slate-colour. On the left side of the chest there were eight ounces of serum, tinged with blood, and nearly an equal quantity on the right side. On cutting into the organs a large quantity of serous fluid, mixed with blood, escaped. The bronchial tubes were filled with a frothy fluid tinged with blood. The pericardium contained an ounce of pale serum; the heart was enlarged,—its cavities contained no blood: the liver and kidneys were, however, much gorged. There was no doubt that the cause of death was the inhalation of charcoal-vapour; and it is probable that the man died from respiring but a comparatively small proportion. The capacity of the chambers must have nearly reached two thousand cubic feet; the deceased had been there only two hours, and when the person who discovered him entered the rooms, the air was not so vitiated but that he could breathe, although with some oppression. The fuel was then in a state of combustion. In a case of death from charcoal-vapour, which was referred to me for examination in 1851, there was a considerable effusion of blood in the submucous tissue of the stomach. This appearance led to a strong suspicion of irritant poisoning. A full investigation of the circumstances, however, showed that the suspicion was unfounded. The vapour had descended through a flue communicating with the bedroom in which deceased slept with her husband: it destroyed the wife, and nearly killed the husband. A stove with burning charcoal had been placed in the room above that in which the couple slept, and an iron pipe conveyed the products of combustion into a flue, whence they descended into the bedroom and caused the fatal accident. In one fatal case there was copious bleeding from the nose. ('Med. Gaz.,' vol. 47, p. 412.) A remarkable instance of the effects produced by the products of combustion is reported by Mr. J. B. Thompson ('Ed. Month. Jour.' 1860, vol. 1, p. 642).

In a case which occurred to M. Guérard the liver and spleen were found gorged with a dark liquid blood; the heart was collapsed, and its cavities were empty, but liquid and dark-coloured blood flowed from the large vessels. The windpipe and bronchi had a red colour, and were filled with frothy mucus. The membranes of the brain were congested, and the sinuses gorged with fluid blood. The face was pale, the eyelids were closed, and the pupils natural. There were livid patches over the body. ('Ann. d'Hyg.,' 1843, vol. 2, p. 57.)

The vapours which escape from ordinary blast-furnaces appear to owe their noxious effects to a mixture of carbonic acid and carbonic oxide. The following case shows in what an insidious manner life may be destroyed by leakage of these vapours: it is reported by Dr. Percy, in his 'Metallurgy' (vol. 2, p. 531). Mr. *Truran*, engineer of the Dowlas Works, was found dead in his office. A brick culvert had been made through a pile of cinders (or cinder-tip) for conveying the blast-gases to the forge-boilers. The deceased's office was built upon this cinder-tip, about from ten to fifteen yards from the side of the culvert. A few days after the gases had been turned through the culvert, Mr. *Truran* went to his office about midday. In the evening, when he did not return home as usual, his family made search for him, and he was found lying dead on the floor of his room. He had been sitting at his desk with some drawings before him, and he had evidently fallen dead from his seat owing to the effect of the gases. The smell of these furnace-gases was quite perceptible on entering the office: the gases had leaked through the cinder-tip and the bricked culvert into the office. The death of the *Halls* (husband and wife) at Sheffield, in January 1852, was owing to a similar leakage into their bedroom of the vapour of smouldering ashes.

Power of locomotion.—It often excites surprise on these occasions that no exertion is made to escape, when it would apparently require but slight efforts on the part of the person affected. The fact is that the action of the vapour is sometimes very insidious: one of its first effects is to create an utter prostration of strength, so that even on a person awake and active, as in the case above related, the gas may speedily produce a perfect inability to move or to call for assistance. For some remarks on the action of charcoal-vapour by Dr. Bird, see 'Guy's Hospital Reports,' April 1839; and for a case illustrative of the dangerous effects of the diluted vapour, see 'Ed. Med. and Surg. Journ.' vol. 1, p. 541. In this instance a charcoal brazier was left, only for a short time, in the cell of a prison. It was removed, and the prisoners went to sleep. They experienced no particular effects at first, but after some hours two were found dead. Thus, then, an atmosphere which can be breathed for a short time with impunity may ultimately destroy life.

In a case of alleged murder by charcoal-vapour, which occurred in Paris a few years since, a question was put to the medical witnesses respecting the *quantity of charcoal* required to be burnt in a particular chamber in order to asphyxiate two adult individuals .('Ann. d'Hyg.' 1837, vol. 1, p. 201; 1840, p. 176: also 'Brit. and For. Rev.' No. 11, p. 240, and No. 23, p. 264.) This question could of course only be answered approximately; because in burning charcoal, the sole product is not carbonic acid, and the substance itself is by no means pure carbon. Then, again, much of the carbonic acid formed may escape in various ways from an imperfectly closed apartment. An attempt was made to infer the quantity of charcoal consumed from the weight of ashes found in the apartment, but no satisfactory answer could be given to this question. The prisoner was, however, convicted of murdering his wife by charcoal-vapour. I have found that ordinary wood-charcoal leaves, after perfect combustion, 3·1 per cent. of its weight of ashes.

M. Devergie has shown that the smothered combustion of *wood* may lead to the evolution of a noxious vapour (carbonic oxide), and give rise to dangerous consequences. ('Ann. d'Hyg.' 1835, vol. 1, p. 442.) His remarks have been recently confirmed by two cases published by MM. Bayard and Tardieu. A man and his wife were found dead in bed. There was a smoky vapour in the apartment, but no fire had been lighted in the grate, and the chimney was blocked up. The planks of the floor were widely separated, and there was a large hole in the boards at the foot of the bed communicating with the apartment below. It was found, on examination, that some joists connected with the flue of an iron plate, which had been heated for making confectionery the previous day, were in a smouldering state; that the vapour had entered the bedroom of the deceased through the crevices in the floor, and, not finding a vent by the chimney, had led to these fatal results. It is remarkable that the source of combustion was nearly nine yards distant, and one person, who slept nearer to the flue of the iron plate, entirely escaped. In the body of the husband the skin was of a reddish tint, the blood liquid, the cavities of the heart empty, the lungs gorged, and there were no subpleural ecchymoses. In the body of the wife there was less redness of the skin; the blood was coagulated in the cavities of the heart, principally on the right side extending to the vessels; less engorgement of the lungs, and a great number of subpleural ecchymoses, indicating that strong efforts had been made to respire. There was at first a rumour of poisoning, which was only removed by a close examination of the locality. (' Ann. d'Hyg.' Oct. 1845, p. 369.)

Combustion in mixtures containing carbonic acid.—In reference to suffocation by carbonic acid, there is one circumstance which requires attention. It is a matter of popular belief—and, in fact, it is generally asserted by writers on Asphyxia—that the burning of a candle in a suspected mixture of carbonic acid and air is a satisfactory proof that it may be respired with safety. Recent observations have, however, tended to show that this statement is not to be relied on as affording an indication of security. A case is related by Dr. Christison, where a servant, on entering a cellar in which grape-juice was fermenting, was suddenly seized with giddiness. She dropped her candle on the floor, but had time to leave the cellar and shut the door behind her, when she fell down senseless. Those who went to her assistance found, on opening the door, that the candle was still burning. Other cases are reported in which persons have been discovered to be in a state of deep coma, while a pan of charcoal was still burning in the apartment (p. 716). The results of some experiments on this subject have led me to the conclusion that a candle will burn in air which is combined with even 10 or 12 per cent. of its volume of carbonic-acid gas: and although such mixtures might not prove immediately fatal to man, yet they would soon give rise to giddiness, insensibility, and ultimately death, in those who, after having been once immersed in them, did not hasten to quit the spot. In air containing a smaller proportion than this (5 or 6 per cent.), a candle will readily burn, but it is probable that such a mixture could not be long respired without causing serious symptoms; hence the *burning of a candle can be no criterion of safety* against the effects of carbonic acid. It is true that in gaseous mixtures, where a candle is extinguished, it would not be safe to venture; but the converse of this proposition is not true—namely, that a mixture in which a candle burns may be always respired with safety.

Diffusion of carbonic acid.—Of late years some important medico-legal questions have arisen, relative to the diffusion of this gas in air, when produced by combustion. It has been supposed that, owing to its great density (1·52), it would collect on the floor of an apartment, would gradually rise upwards, and suffocate persons at different times, according to the level on which they might happen to be placed. Questions on this subject have been variously answered, and a great difference of opinion has arisen among witnesses. There are two important points on which a correct answer to this enquiry must be based:—1st. The law of the diffusion of gases; and 2ndly. The effect of heat in greatly diminishing the specific gravity of a gas naturally heavier than air. There is no doubt that in a narrow or confined vessel, exposed to air, carbonic acid is slow in escaping;—nevertheless it mixes with air, and passes off rapidly in proportion to the surface exposed. In the course of an hour or two, in spite of its great specific gravity, none will be contained within the vessel. The well-known Grotta del Cane at Pozzuoli has been referred to by those who hold that carbonic acid always tends to remain on the lowest level; but it has been forgotten that, in this and other similar excavations, carbonic acid is continually issuing from crevices in the soil, so that that which is lost by diffusion is continually replaced: hence the illustration proves nothing. It may suffice to state, that air and carbonic acid mix readily on contact in all proportions, although they enter into no chemical combination. Thus then, at common temperatures, carbonic acid has no tendency to remain on the floor or soil, when there is a free access of air or contact with other gases. The heat of combustion diminishes the specific gravity of the gas, and the carbonic acid therefore ascends with the heated current of air, and diffuses itself in the upper part of an apartment, when there are no means of carrying it off. This is a fact demonstrable by many simple experiments. In burning a quantity of charcoal actively in an open brazier raised above the floor in a large apartment, I found that the proportion of carbonic acid was nearly equal in air taken from a foot above and a foot below the level of the source of combustion, there being no lateral currents to affect the results. Hence it follows that carbonic acid produced by combustion has no tendency to collect at the lowest level—that it is uniformly diffused around; and probably it would be found, by careful experiments, that within apartments of small dimensions—those in which persons are often accidentally suffocated—the upper strata of air contain as much or even more carbonic acid than the lower. For this reason a room with a low ceiling is more dangerous than one which is high-pitched.

In a very large apartment, it would of course be improper to test the suffocating properties of the air, by the examination of it at a great distance from the source of combustion; since a person situated near this spot might be destroyed, while one at a distance might escape—the carbonic acid not having completely diffused itself; or, supposing it to have become entirely diffused, the proportion may be so small as to render it harmless. It is well known, by the effects of the vapour of a limekiln, that one lying at the edge of the kiln may be destroyed, while another at ten yards' distance, either on the same level or below it, may entirely escape; and it would not be possible, in such a case, to speculate upon the proportion of carbonic acid which had destroyed life, except by collecting the air from the spot where the accident occurred, and at or about the time of its occurrence. Another fallacy appears to be, that because a dead body is found recumbent, it is to be inferred that the person must have lain down and have been destroyed while sleeping. The dead body of a person must always be found thus lying on a floor, unless it be supported; but suffocation may have actually taken place, or at least have commenced, when the deceased was in the sitting or erect posture. Admitting that carbonic acid diffuses itself rapidly from combustion in a small and closed apartment, it has been supposed that, after having become mixed with the air, it would again in great part separate, and, owing to its superior density, fall to the lowest level on cooling. In answer to this it may be said,—1. That there are no facts to support the opinion, while there are many against it; for we do not find that heavy and light gases, when once really mixed, ever again separate from each other.—2. Practically this explanation amounts to nothing; because before the gas had cooled and reacquired its density, its asphyxiating properties would probably have had their full effect on all living persons within its reach. Persons are not suffocated by carbonic acid after the fuel is extinguished, and the apartment cooled; but the poisonous action of the gas is commonly manifested while the fuel is still burning. The inferences which, it appears to me, we are entitled to draw from the preceding observations, are,—1. That in a small and close apartment, persons are liable to be suffocated at all levels, from the very equal and rapid diffusion of carbonic acid during combustion;—2. That in a large apartment, unless the gas be very rapidly diffused by a current the air around the source of combustion may become impregnated with a poisonous proportion, while that at a distance might be still capable of supporting life; because carbonic acid requires time for its perfect and equable diffusion in a very large space.

Carbonic oxide.—The noxious effects of the vapour of burning charcoal are now considered to be due chiefly to the presence of carbonic oxide. The action of this gas upon animal life has been made a subject of experiment by Bernard ('Leçons sur les Substances Toxiques,' p. 164). An atmosphere containing from 5 to 6 per cent. will destroy life. The blood is brightened in colour by this gas, while it is darkened by carbonic acid. Bernard has observed that this bright colour has been retained for three weeks; and he considers the mode of action of this gaseous poison to be, that it prevents the arterial blood of the body from becoming venous, while carbonic acid operates by preventing the venous blood from becoming arterial. (Op. cit., pp. 182, 195.)

This condition of the blood as a result of the action of carbonic oxide may occasion some doubt of the cause of death, in cases of suffocation by fire. In April 1858 an enquiry took place into the cause of death of fourteen persons, owing to a fire in a house in Bloomsbury. The medical witness, on examining the bodies, found a redness of the muscles and a redness of the blood. He therefore thought that death was not caused by suffocation, but from the inhalation of arsenical vapours, owing to some minerals containing arsenic having been partially consumed during the fire. But there was a total want of evidence to show that the vapours of arsenic, when breathed, would cause death so speedily as the noxious gases evolved by fire, or that they would redden the blood and muscles. On the other hand, the respiration of carbonic oxide would explain these facts. It is worthy of remark that in many of the observed cases of death from charcoal-vapour, the blood has had a darker colour than natural: the greater solubility of carbonic acid, and the larger proportion in which it is produced, may account for this effect.

The action of carbonic oxide on the body is that of a pure narcotic poison. M. Tourdes has ascertained that rabbits died in twenty-three minutes, when kept in an atmosphere containing 1-15th of its volume of pure carbonic oxide; when the proportion was 1-30th they died in thirty-seven minutes, and when 1-8th in seven minutes. Dr. Letheby states that in his experiments a mixture of $\frac{1}{2}$ per cent. killed small birds in three minutes, and of 1 per cent. in about half this time. The animals showed no sign of pain: they fell insensible, and either died at once, without convulsions, or they gradually passed into a state of profound coma. He found, on inspection, that the blood was redder than usual, that the muscles of the heart were somewhat gorged, and that the brain was congested. ('Lancet,' March 1, 1862, p. 219.)

COAL AND COKE VAPOURS. SULPHUROUS ACID.

Products from burning coal and coke.—The gases extricated in the smothered combustion of coal or coke are of a compound nature. In addition to carbonic acid and carbonic oxide, we may expect to find in the atmosphere of a close room in which such a combustion has been going on, SULPHUROUS ACID GAS, and from coal, in addition to this, the sulphuretted and carburetted hydrogen gases. These emanations are equally fatal to life; but in consequence of their very irritating properties they give warning of their presence, and are therefore less liable to occasion fatal accidents. From an accident which occurred at Colchester a few years since, in which two children lost their lives, it would appear that some persons are so ignorant as to believe that the vapour of coke is less fatal than the vapour of charcoal. The sulphurous acid gas, when existing in a small proportion in air, has the effect of irritating the air-passages so violently that, if accidentally respired, it would commonly compel the person to leave the spot before the vapours had become sufficiently concentrated to destroy life. Nevertheless, accidents from the combustion of coal and coke sometimes occur.

Symptoms and appearances.—The following cases will convey a knowledge of the symptoms and appearances which may be met with on these occasions. Some years since four persons, in a state of asphyxia, were brought into Guy's Hospital. It appeared that on the previous evening they had shut themselves up in the forecastle of a coal-brig, and had made a fire. About 6 or 7 o'clock on the same evening some of the crew accidentally placed a covering over the flue on the outside, and thus stopped the escape of smoke from the fire, which was made of a kind of coal containing much sulphur. Early in the morning one of the crew, on opening the hatches, observed three of the inmates lying on the floor senseless and frothing at the mouth, and the fourth in his crib in a similar condition. The air in the place was most offensive. After the men were brought on deck one of them, aged 21, began to recover, and when brought to the hospital he seemed only giddy, as if intoxicated: he soon completely recovered. Another, aged 40, after breathing oxygen-gas and having brandy and ammonia exhibited to him, showed no symptoms of recovery, but died in a few hours. A third, aged 17, soon began to rally, and in a few hours he was able to answer questions; he declared that at the time of the accident he felt no pain, sense of oppression or weight, either in his head or chest. The fourth, aged 15, died the following day, having exhibited no symptoms of rallying. Stimulants were administered and warm fomentations were used, but all efforts to produce reaction failed. The appearance of these persons when brought in was as follows:—The lips were purple, the countenance was livid, and the surface of the body cold; the hands and nails were purple; the respiration was quick and short—the pulse small, quick, and feeble; the pupils were fixed, and there was total insensibility. The body of the man aged 40 was inspected four hours after death. The membranes of the brain were congested, and there was a large quantity of fluid under the arachnoid or middle membrane; the sinuses were gorged with blood; the lungs were in a state of great congestion, as were also the right cavities of the heart. It was remarked that, in its congested condition, this corpse was similar in appearance to that of an executed culprit. The body of the lad aged 15 was inspected about thirty-three hours after death. Under the pia mater or inner membrane of the brain was observed one small ecchymosed spot; in the substance of the brain there were more bloody points than usual; a small quantity of fluid was found under the arachnoid membrane, and the sinuses were full of coagulated blood. The lungs showed no congestion, but the right cavities of the heart were much distended with blood. (For a report of cases of recovery from the effects of coal-vapour, see 'Med. Gaz.,' vol. 9, p. 935; also 'Dub. Med. Press,' Jan. 31, 1849, p. 69, and 'Med. Gaz.,' vol. 43, p. 937.)

A case showing the fatal effects of coal-vapour has been published by Dr. Davidson. A man lost his life from sleeping in a closed room with a fire to which there was no flue. The lungs were found gorged with blood, and the windpipe and bronchi were filled with a frothy muco-sanguineous fluid; the mucous membrane beneath was slightly injected; there was a small effusion in each pleural cavity; the right side of the heart was full of dark liquid blood; the dura mater was much injected; the sinuses of the brain and the veins of the pia mater were completely congested, and there was subarachnoid effusion. The substance of the brain, when cut, presented numerous bloody points. ('Ed. Month. Jour.,' April 1847, p. 763.) In the 'Medical Times and Gazette' (April 3, 1852, p. 353) the reader will find an account of three cases of recovery from the effects of coal-vapour. (See also, for other cases which proved fatal, the same journal, March 31, 1860, p. 323.)

Analysis.—Sulphurous acid is immediately known by its powerful and suffocating odour, which resembles that of burning sulphur. The best test for its presence is a mixture of iodic acid and starch, which speedily acquires a blue colour when exposed to the vapour.

The products of the combustion of impure *coal-gas* are equally destructive to life: they consist of carbonic acid and sulphurous and nitric acids.

VAPOURS OF LIME, BRICK, AND CEMENT-KILNS.

Gaseous products from lime-burning.—In the burning of lime carbonic acid is given out abundantly, but, owing to the nature of the fuel used, carbonic oxide and sulphurous acid are mixed with it. Persons who have incautiously slept in the neighbourhood of a burning limekiln during a winter's night, have been destroyed by the respiration of these vapours. The discovery of a dead body in such a situation would commonly suffice to indicate the real cause of death; but a practitioner ought not to be the less prepared to show that there existed no other apparent cause of death about the person. It is obvious that a person might be murdered, and the body placed subsequently near a kiln by the murderer in order to avert suspicion. If there are no marks of external violence, the stomach should be carefully examined for poison; in the absence of all external and internal injuries, medical evidence will avail but little; for a person might be criminally suffocated, and his body, if found under the circumstances above stated, would present scarcely any appearances upon which a medical opinion could be securely based. An accident is related by Foderé to have occurred at Marseilles, in which seven persons of a family were destroyed, in consequence of their having slept on the ground-floor of a house in the courtyard of which a quantity of limestone was being burnt into lime. They had evidently become alarmed, and had attempted to escape; for their bodies were found lying in various positions. The courtyard was enclosed, and the carbonic acid had poured into the apartment through the imperfectly closed window and door. In November 1838 a man died three days after being exposed to the vapours of a limekiln. ('Guy's Hosp. Rep.,' April 1839.) The vapours of *brick-kilns* are equally deleterious, the principal agent being carbonic acid mixed with carbonic oxide; although I have found that, according to the stage of combustion of the fuel, ammonia, hydrochloric acid, sulphuretted hydrogen, and sulphurous acid may be also evolved. In September 1842 two boys were found dead on a brick-kiln near London, whither they had gone for the purpose of roasting potatoes. Although the cause of death in the two cases was clearly suffocation, in one instance the body was extremely livid, while in the other there was no lividity whatever! Such accidents are frequent: in November 1844 an inquest was held at Manchester on the body of a man who had died under similar circumstances. The vapours of *cement-kilns* are quite as noxious as those of brick-kilns: carbonic and sulphurous acids predominate in them.

CONFINED AIR.

Symptoms and effects.—An animal confined within a certain quantity of air, which it is compelled to respire, will soon fall into a state of lifelessness. A human being in the same way may be suffocated, if confined in a close apartment where the air is not subject to change or renewal, while the products of respiration are accumulated; and the effects are hastened when a number of persons are crowded together in a small space. The change which air, thus contaminated by respiration, undergoes may be very simply stated. The quantity of nitrogen in 100 parts will remain nearly the same; the quantity of oxygen will probably vary from 8 to 12 per cent., while the remainder will be made up chiefly of carbonic acid. If many persons are crowded together the air will acquire a high temperature, and will be saturated with aqueous vapour which contains decomposing animal matter derived from the lungs and skin. From this statement, it is evident that air which has been contaminated by continued respiration will operate fatally on the human body, partly in consequence of its being deficient in oxygen, and partly from the noxious effects of the carbonic acid contained in it. The proportion in which carbonic acid exists in respired air is subject to variation: according to the experiments of Allen and Pepys, it never exceeds 10 per cent. by volume of the mixture, how frequently soever it may have been received into and expelled from the lungs. The influence of respiration on air may be thus stated:—An adult consumes from one to two gallons of air per minute, and the air expired contains from 4 to 5 per cent. of carbonic acid; but it is a remarkable fact that, when a person continues to breathe the same air, the proportion of carbonic acid expelled is reduced at each successive respiration. When the amount in air has reached 10 or 12 per cent. no more is thrown off by the lungs, and the blood is no longer depurated. For healthy existence a human being requires 20 cubic feet or 125 gallons of air per hour. A common candle will consume as much as two gallons of air per minute, or render that quantity of air unfit for respiration. Dalton found that the air in crowded rooms contained about 1 per cent. of carbonic acid, the atmospheric proportion being therefore increased nearly twentyfold. It is certain that insensibility and death would ensue in a human adult before the whole of the oxygen of the confined air had disappeared; but the opportunity can rarely present itself of analysing such a contaminated mixture, and hence it is impossible to specify the exact proportion in which carbonic acid would exist when the confined air proved fatal to persons who had respired it. M. Lassaigne has shown, by direct experiment, that the carbonic acid in the air of close rooms is not collected on the floor, but equally diffused throughout. The whole mass of air is, in fact, vitiated, and requires renewal. ('Med. Gaz.,' vol. 38, p. 351; see also 'Report on Mines,' 1864, App. B, p. 196, and 'Chemical News,' Feb. 17, 1865, p. 79.)

COAL-GAS. CARBURETTED HYDROGEN.

Coal-gas is a compound which acts directly as a poison when respired. Many fatal accidents have occurred from the respiration of air contaminated with it. Its composition is subject to much variation, according to circumstances. Mitscherlich found that it was principally composed of light carburetted hydrogen, hydrogen, and carbonic oxide, in the proportions of 66 per cent. of the first, 21·3 of the second, and 11 of the third. M. Tourdes found that the proportions of light carburetted hydrogen and carbonic oxide were nearly equal, *i.e.* about 22 per cent. An analysis of coal-gas as supplied to London shows that in 1000 parts it contains—of hydrogen, 464·3; of light carburetted hydrogen, 389·3; carbonic oxide, 56·2; olefiant gas, 38·6; watery vapour, 24·8; nitrogen, 22·2; carbonic acid, 4·6. The difference in composition depends on the heat to which the gas has been submitted. Some consider that CARBONIC OXIDE is the poisonous principle; but there is no doubt that the hydrocarbons also have a noxious influence, although the use of the safety-lamp in mines proves that a mixture of light carburetted hydrogen with air in an explosive proportion, may be respired without producing serious effects.

Symptoms and appearances after death.—The symptoms produced by coal-gas, when mixed in a large proportion with air, are—giddiness, headache, nausea with vomiting, confusion of intellect, loss of consciousness, general weakness and depression, partial paralysis, convulsions, and the usual phenomena of asphyxia. The appearances after death will be understood from the following cases. In January 1841 a family residing at Strasburg respired for forty hours an atmosphere contaminated with coal-gas, which had escaped from a pipe passing near the cellar of the house in which they lodged. On the discovery of the accident four of the family were found dead. The father and mother still breathed, but, in spite of treatment, the father died in twenty-four hours: the mother recovered. When the five bodies were inspected there was a great difference in the appearances; but the principal changes observed were, congestion of the brain and its membranes,—the pia mater (inner membrane) being gorged with blood, and the whole surface of the brain intensely red. In three of the cases there was an effusion of blood (coagulated) on the dura mater and in the spinal canal. The lining-membrane of the air-passages was strongly injected, and there was spread over it a thick viscid froth tinged with blood; the substance of the lungs was of a bright-red colour, and the blood in the vessels was coagulated. ('Ann. d'Hyg.' Jan. 1842.) In two cases communicated by Mr. Teale to the 'Guy's Hospital Reports' (No. 8), there was found congestion of the brain and its membranes, with injection of the lining-membrane of the air-passages; the blood was remarkably liquid. An aged female and her granddaughter, who had been annoyed by the escape of gas during the day, retired to bed, and they were found dead about twelve hours afterwards.

Mr. Bloxam has published a case of poisoning by coal-gas, which shows how easily life may be destroyed by it. The appearances in the body are more fully described than usual. In November 1861 Mr. Bloxam saw the deceased, who was a gas-fitter: he was supported in a sitting posture on the floor. The man had accidentally respired coal-gas while connecting a tube with a meter. The skin was cold, the cornea glazed, and the face pale and placid; there was some froth about the mouth, the pupils were rather dilated, and the limbs supple. There was a strong smell of gas in the place. He was working in a closet, and he was found insensible on the top of a pair of steps in a sitting posture,—his head on one side, his arms hanging down, and his back leaning against the wall, in the attitude in which he was engaged at his work. He had evidently died quietly and placidly on his seat, and had made no attempt to descend the steps. He was last seen alive an hour before he was found dead, and he no doubt died rapidly from the inhalation of the gas. An inspection of the body was made twenty-four hours after death. *Externally* the skin of the face and upper part of the body was pale,—rigidity was well-marked, and there was general lividity of the back of the body as well as of the limbs. The blood was everywhere fluid. The brain and its membranes were not congested, but were rather pale than otherwise; the ventricles contained a pale serum. The brain and cerebellum were apparently healthy. There was a strong odour of coal-gas on exposing the brain. The lungs were of a dark-red colour, and did not collapse on raising the chest-bone; they were dark at the back of the lobes from gravitation of blood; their structure was healthy. The windpipe and bronchi contained frothy mucus in some quantity. A powerful odour of gas was perceived on compressing the lungs. The heart was healthy; the right cavities were distended with blood—the left were nearly empty; the blood was everywhere black. There was congestion of the abdominal viscera, but no other unusual appearance. ('Med. Chir. Trans.' 1862, vol. 45, p. 103).

In the cases above related, the effects produced by coal-gas were owing to the long-continued respiration of it in a diluted state. The quantity contained in the air of the rooms must have been very small: in M. Tourdes' case it was probably not more than 8 or 9 per cent., because at a little above this proportion the mixture with air becomes explosive; and there had been no explosion in this case, although in the apartment in which the persons were found dead, a stove had been for a long time in active combustion, and a candle had been completely burnt out. In Mr. Teale's cases those who entered the house perceived a strong smell of coal-gas, but still the air could be breathed. Coal-gas therefore, like other aërial poisons, may destroy life if long respired, although so diluted as not to produce any serious effects in the first instance! This gas owes its peculiar odour to the vapour of naphtha:

the odour begins to be perceptible in air when the gas forms only the 1000th part, it is easily perceived when forming the 700th part, but the odour is strongly marked when it forms the 150th part (Tourdes). In most houses in which gas is burnt, the odour, owing to leakage, is plainly perceived; and it is a serious question whether health and life may not often be affected by the long-continued respiration of an atmosphere containing but a small proportion. The odour will always convey a sufficient warning against its poisonous effects. It should be known that this gas will penetrate into dwellings in an insidious manner. In Mr. Teale's cases, the pipe from which the gas had escaped was situated about ten feet from the wall of the bedroom where the females slept: the gas had permeated through the loose earth and rubbish, and had entered the apartment through the floor. I have notes of several other cases in which coal-gas has thus destroyed life by leakage into bedrooms.

It is impossible to determine exactly what proportion of this gas in air will destroy life. An atmosphere containing from 7 to 12 per cent. has been found to destroy dogs and rabbits in a few minutes; when the proportion was from 1½ to 2 per cent. it had little or no effect. With respect to man, it may destroy life if long respired when forming about 9 per cent., *i.e.* when it is in less than an explosive proportion. (See 'British and Foreign Med. Rev.' Vol. 20, p. 253; also, 'Ann. d'Hyg.' 1830, vol. 1, p. 457.) Dr. Aldis observed in his experiments that in ordinary coal-gas mixed with air, rats were rendered insensible in half a minute, and died in a minute and a half to two minutes. There was before death spasmodic action of the diaphragm. The gas was allowed to enter slowly into a bell-jar of air in which the animals were placed. ('Med. and Chir. Trans.' 1862, vol. 45, p. 100).

Analysis.—The circumstances under which the accident occurs will generally suffice to establish the nature of the noxious agent. Coal-gas burns with a bright-white light, producing carbonic acid and water. A taper should be cautiously applied to a small quantity; since, when the gas is mixed with the air in the proportion of from 11 to 14 per cent. it is dangerously explosive. For this reason no lighted candle should be taken into an apartment where an accident has occurred, until all the doors and windows have been for some time kept open, and the smell of gas has entirely disappeared. (See 'Med. Gaz.' vol. 42, p. 343.) The combustion of the gas, or its explosion with air, is a sufficient test of its nature; the peculiar odour, and the want of action on a salt of lead, if the gas is pure, will distinguish it from sulphuretted hydrogen.

CHAPTER 56.

SULPHURETTED HYDROGEN GAS—ITS POISONOUS PROPERTIES—SYMPTOMS—POST-MORTEM APPEARANCES—EFFLUVIA OF DRAINS AND SEWERS—ANALYSIS—MEPHITIC VAPOURS—EXHALATIONS FROM THE DEAD.

SULPHURETTED HYDROGEN has a more powerful action on the body than either carbonic acid or charcoal-vapour. Persons are sometimes accidentally killed by it; but the very offensive odour which a small portion of it communicates to a large quantity of air is sufficient to announce its presence, and thus, with due caution, to prevent any dangerous consequences. Sulphuretted hydrogen gas, when respired in its pure state, is instantaneously fatal. It exerts equally deleterious effects upon all orders of animals, and upon all the textures of the body. It has been found to destroy life even when it is allowed to remain in contact with the skin. Mr.

Donovan states that a rabbit enclosed in a bladder of sulphuretted hydrogen gas, but allowed to breathe freely in the atmosphere, perished in ten minutes. When introduced into the lungs of animals, even in a diluted state, it has given rise to fatal consequences. Thus Thénard found that air which contained only 1-800th of its volume of this gas would destroy a dog, and that when the gas existed in the proportion of 1-250th it sufficed to kill a horse. The later researches of M. Parent-Duchâtelet have, however, shown that the poisonous effects of the gas have been somewhat exaggerated, at least in the application of these results to man. He observed that workmen breathed with impunity an atmosphere containing 1 per cent. of sulphuretted hydrogen; and he states that he himself respired, without serious symptoms ensuing, air which contained *three per cent.* In most drains and sewers, rats and other vermin are found to live in large numbers; and, according to Gaultier de Claubry, the air in those localities contains from 2 to 8 per cent. (Devergie, vol. 2, p. 520.) Thus, admitting sulphuretted hydrogen to be a more powerful poison than charcoal-vapour, it does not appear to be so energetic as Thénard's experiments would lead us to suppose. An atmosphere containing from 6 to 8 per cent. of the gas might speedily kill, although nothing certain is known of the smallest proportion required to destroy human life. One fact, however, is worthy the attention of medical jurists—namely, that the respiration of an atmosphere only slightly impregnated with the gas may, if long continued, seriously affect a person, destroy health, and even cause death. M. d'Arcet was required to examine a lodging in Paris, in which three young and healthy men had died successively, in the course of a few years, under similar symptoms. The lodging consisted of a bedroom with a chimney, and an ill-ventilated anteroom. The pipe of the privy passed down one angle of the room by the head of the bed, and the wall in this part was damp from infiltration. At the time of the examination there was no perceptible smell in the room, although it was small and low. M. d'Arcet attributed the mortality in the lodging to the slow and long-continued action of the emanations from the pipe; and it is highly probable that this was the real cause. ('Ann. d'Hyg.,' Juillet 1836.) The men who were engaged in working at the Thames Tunnel suffered severely during the excavation, from the presence of this gas in the atmosphere in which they were obliged to work. The case was referred to me for examination by Sir I. M. Brunel in 1839. The air, as well as the water which trickled through the roof, was found to contain sulphuretted hydrogen: it was probably derived from the action of the water on iron-pyrites in the clay. The gas issued in sudden bursts, so as to be at times perceptible by its odour. By respiring this atmosphere the strongest and most robust men were, in the course of a few months, reduced to an extreme state of exhaustion, and several died. The symptoms with which they were first affected were giddiness, sickness, and general debility; they became emaciated, and fell into a state of low fever, accompanied by delirium. In one case which I saw, the face of the man was pale, the lips of a violet hue, the eyes sunk with dark areolæ around them, and the whole muscular system was flabby and emaciated. Chloride of lime and other remedies were tried for the purification of the air; but the evil did not entirely cease until the tunnel was so far completed that there was a communication from one side to the other, and free ventilation throughout.

Symptoms.—The symptoms produced by sulphuretted hydrogen on the human body vary according to the degree of concentration in which it is respired. When breathed in a moderately diluted state, the person speedily falls inanimate. An immediate removal to pure air, and the application of stimulants, with cold affusion, may, however, suffice to restore life.

According to the account given by those who have recovered, this state of inanimation is preceded by a sense of weight in the stomach and in the temples; also by giddiness, nausea, sudden weakness, and loss of motion and sensation. If the gas in a still less concentrated state be respired for some time, coma, insensibility, or tetanus with delirium supervenes, preceded by convulsions, or pain and weakness over the whole of the body. The skin in such cases is commonly cold, the pulse irregular, and the respiration laborious. When the air is but slightly contaminated with the gas, it may be breathed for a long time without producing any serious symptoms; sometimes there is a feeling of nausea or sickness, accompanied by pain in the head, or diffused pains in the abdomen. These symptoms are often observed to affect those who are engaged in chemical manipulations with this gas. Sulphuretted hydrogen appears to act like a narcotic poison when highly concentrated, but like a narcotico-irritant when much diluted with air. It is *absorbed* into the blood, to which it gives a brownish-black colour, and it is in this state circulated throughout the body. In all cases a noxious atmosphere containing this gas is indicated by an offensive smell producing nausea and sickness. For a case of poisoning by this gas, in which the person recovered, see ‘Medical Gazette,’ vol. 43, p. 871.

Appearances after death.—On examining the bodies of persons who have died from the effects of sulphuretted hydrogen, when respired in a concentrated form, and the inspection is recent, the following appearances have been observed:—The mucous membrane of the nose and throat is commonly covered by a brownish viscid fluid. An offensive odour is exhaled from all the cavities and soft parts of the body. These exhalations, if received into the lungs of those engaged in making the inspection, sometimes give rise to nausea and other unpleasant symptoms, and may even cause syncope or asphyxia. The muscles of the body are of a dark colour, and are not susceptible of the galvanic stimulus. The lungs, liver, and the soft organs generally, are distended with black liquid blood. There is also great congestion about the right side of the heart, and the blood has been found everywhere liquid and dark-coloured: the body rapidly undergoes the putrefactive process. When death has occurred from the respiration of this gas in a more diluted form, the appearances are less marked. There is then general congestion of the internal organs, with a dark and liquid state of the blood. In fact, in such cases the appearances can scarcely be distinguished from those produced by carbonic acid. Four men lost their lives in the Fleet Lane Sewer in February 1861: they were found dead, and there was no doubt that sulphuretted hydrogen was the cause of death. An account of the appearances presented by the bodies is given in the ‘Lancet’ by Mr. Holden and Dr. Letheby (February 23, 1861, p. 187). The eyes and mouth were open, the lips and tongue livid, the pupils widely dilated, the blood black and fluid, the lungs congested, the heart full of black fluid blood, the right side gorged, and there was a bloody froth in the windpipe. In the brain the large vessels of the dura mater were full of black fluid blood.

In June 1857 six persons lost their lives, at *Cleator Moor* near Whitehaven, by the respiration of sulphuretted hydrogen in a diluted form, by reason of their having slept in small close ill-ventilated rooms, into which the gas had penetrated. Three of the deceased persons—a husband, wife, and child, of one family (*Armstrong*)—had retired to rest, in their usual health, on the night of the 9th of June. Two of them were found the next morning dead in bed, and a third (the child) was found in a state of insensibility, and lingered until the afternoon of the same day, when she died. The fourth, a healthy adult, retired to sleep in his bed, with his door closed, and he was found dead in *an hour*. The fifth, a child, was taken ill on the morning of the 11th, and died the same day. The sixth was taken ill on the morning of the 10th, and died on the 12th of June.

The symptoms complained of by some who recovered were nausea, sickness, giddiness, and insensibility. On inspection of the body of one child, the pupils were found dilated,—viscid mucus escaped from the nostrils,—there was congestion of the lungs and kidneys, as well as of the membranes of the brain. In the adult who died in an hour, the pupils were natural, the jaws firmly clenched, the fingers contracted, and the nails blue; there was great cadaveric lividity, and a quantity of fluid with frothy mucus issued from the nostrils and mouth. The lungs were much congested, and serum was effused in the cavity of the chest. The heart contained a little fluid blood, and was somewhat flaccid. The membrane of the windpipe and gullet was redder than natural. In the windpipe there was frothy mucus. The stomach, as well as the large and small intestines, were highly congested, but otherwise healthy. The brain and its membranes were greatly engorged with blood, which, as in the body generally, was very dark and fluid. Mr. J. B. Wilson, who examined the body of the child, drew the conclusion, which was confirmed by the subsequent inquiry, that death had been caused by sulphuretted hydrogen. Dr. Thompson, who examined the body of the man, also inferred that some noxious gas or gases had destroyed life. Having been required by the Home Office to investigate the cause of death in these cases, I visited Cleator on the 22nd of June, and found that the cottages in which the accidents had occurred, were built upon a heap of iron-slag, which also abutted on the premises behind. This slag contained, among other matters, sulphide of iron and sulphide of calcium. A foul smell, compared to that of cinders extinguished by water, had for some time been perceived about the rooms, chiefly at night, when the doors and windows were closed; and the day before the occurrence a heavy storm of rain had washed through the slag-heap, and aggravated the effects. The heap of slag was burning in certain parts, and sulphuretted hydrogen was evolved in large quantities at a depth of a few feet below. At the time of my visit, *i.e.* a fortnight after the deaths, on removing the flags in the lower rooms, the slag below was found damp, and sulphuretted hydrogen was still issuing from it. The white-lead paint in the closets was partly converted into black sulphuret, and this chemical change was found in patches on the chamber-door of one small room in which two persons had died.

The symptoms, so far as they were observed in the living, the appearances in the dead bodies, and the chemical nature of the wet slag beneath the foundation, left no reasonable doubt that during the night, with the doors and windows closed, sulphuretted hydrogen had escaped in sufficient quantity to poison the air and destroy life, and a verdict was returned to this effect. A suggestion was made that carbonic acid might have caused the symptoms and death, but there was no source of carbonic acid but the breath; and there is, I believe, no instance known of any adult having breathed himself to death in an hour, in a room containing 600 cubic feet of air,—not to mention that persons had slept in similar rooms in the same row of cottages, at a distance from the slag-heap, without perishing from such a cause. Another theory was put forward, to the effect that carbonic oxide in the vapours of some blast-furnaces had found its way into the rooms where these persons had died; but the nature of the locality and the distance of the furnaces rendered this impossible. Persons who had left their windows open, whereby these vapours might have entered, escaped, while the deaths occurred only in those houses in which the doors and windows were completely closed. It is highly probable that the sulphuretted hydrogen was mixed with other gases and vapours, as it is never found pure except in a chemical laboratory;

but the circumstances left no reasonable doubt that it was the principal agent of death. This seems to have been clearly established by the fact, that since a channel has been cut through the slag-heap, and the slag removed, no casualty has taken place.

As in reference to carbonic acid, an atmosphere which may be breathed for a short time with impunity will ultimately destroy life. Sulphuretted hydrogen in a fatal proportion, however diluted or mixed with other vapours, would always be indicated by a disagreeable smell; although from habit, as well as probably from the effects of the gas on the nervous system, this offensive smell might not be perceived when a person had remained for a short time in the poisoned atmosphere. In the case of the *Halls*, which occurred at Sheffield in 1852, there is reason to believe that the deaths of two persons were caused by the smouldering of ashes in a cesspool ('Association Medical Journal,' April 1853, p. 280). Mr. Haywood considered that carbonic acid was the agent in this case, although it is probable, from the nature of the materials in which combustion was going on, that sulphuretted hydrogen and other gases and vapours were simultaneously evolved.

Effluvia of drains and sewers.—The most common form of accidental poisoning by sulphuretted hydrogen (for it is rare that a case occurs which is not purely accidental) is witnessed among nightmen and others who are engaged in cleaning out drains and sewers, or in the removal of nightsoil. These accidents are much more frequent in France than in England, the soil being often allowed to collect in such quantities in Paris and other large continental cities, as to render its removal a highly dangerous occupation for the workmen. According to the results of Thénard's observations, there are two species of compound gases, or mechanical mixtures of gases, which are commonly met with in the exhalations of privies. The first compound consists of a large proportion of atmospheric air holding diffused through it, in the form of vapour, the *hydrosulphate of ammonia* (sulphide of ammonium). The hydrosulphate is contained abundantly in the water of the soil, and is constantly rising from it in vapour, and diffusing itself in the surrounding atmosphere. It is this vapour which gives the unpleasant and pungent odour to the effluvia, and causes an increased secretion of tears in those who unguardedly expose themselves to such exhalations. The *symptoms* produced by the respiration of this gaseous mixture, when in a concentrated state, bear a close resemblance to those which result from the action of sulphuretted hydrogen gas. If a person is but slightly affected, he will probably complain of nausea and sickness: his skin will be cold, his respiration free but irregular; the pulse is commonly frequent, and the voluntary muscles, especially those of the chest, are affected by spasmodic twitchings. If more strongly affected he loses all power of sense and motion; the skin becomes cold, the lips and face assume a violet hue, the mouth is covered by a bloody and frothy mucus; the pulse is small, frequent, and irregular—the respiration hurried, laborious, and convulsive; and the limbs and trunk are in a state of general relaxation. If still more severely affected, death may take place immediately; or should the person survive a few hours, in addition to the above symptoms there will be short but violent spasmodic twitchings of the muscles, sometimes even accompanied by tetanic spasms. (See 'Ann. d'Hyg.' 1829, vol. 2, p. 70). If the person is sensible he will commonly suffer the most severe pain, and the pulse may become so quick and irregular that it cannot be counted. When the symptoms are of such a formidable nature, it is rare that a recovery takes place. The *appearances* met with on making an examination of the body are similar to those observed in death from sulphuretted hydrogen. The inspection should be made with caution, for a too-frequent respiration of the poisonous exhalations may seriously affect those who undertake it.

A singular accident occurred in this metropolis in August 1847, in which a man lost his life by the evolution of a quantity of sulphuretted hydrogen from a foul drain. It appears that, shortly before the accident, a large quantity of oil of vitriol had been poured down the drain communicating with the privy. The deceased entered the yard, and was soon afterwards found on the pavement in a dying state. On inspection of the body, the brain was healthy, but the lungs were gorged with blood, which had the offensive odour of sulphuretted hydrogen gas. The medical witness referred death to this gas, and stated that lime had been thrown into the drain, that sulphuret of calcium had probably been formed, and that the sulphuretted hydrogen, which had led to the death of the deceased, had been evolved from this by the oil of vitriol. It is more probable, however, that the gas was evolved by the decomposition of the liquid hydrosulphate of ammonia, which always abounds in such localities. In February 1861 four men lost their lives in the Fleet Sewer: they had gone to work in an ill-ventilated part, and were found dead soon afterwards.

The following case, which has some relation to this subject, occurred in London in 1831:—Twenty-two boys, living at a boarding-school at Clapham, were seized in the course of three or four hours with alarming symptoms of irritation in the stomach and bowels, spasms of the muscles of the arms, and excessive prostration of strength. One child, that had been similarly attacked three days before, died in twenty-five hours, and one among the last attacked died in twenty-three hours. Both of the bodies were examined after death: in the first the mucous glands of the intestines were found enlarged and, as it were, tuberculated; in the second the mucous coat of the small intestines was found ulcerated, and *that* of the colon softened. At first it was suspected that the boys had been poisoned, but an analysis of the food did not lead to the discovery of any noxious substance. The only circumstance which was considered sufficient to explain the accident was, that *two days* before the first child was seized, a foul cesspool had been opened, and the materials diffused over a garden adjoining the children's playground. This was the source of the noxious effluvia, according to the opinion expressed by six medical practitioners. ('Christison on Poisons,' p. 810.)

Analysis.—The recognition of these gases and vapours is a simple operation. The odour which they possess is sufficient to determine their presence, even when they are diluted with a large quantity of atmospheric air. The *sulphuretted hydrogen gas* is at once identified by its action on paper previously dipped in a solution of a salt of lead: if present, even in very small proportion (1-100,000th part), the moistened paper speedily acquires a brownish-black stain from the production of sulphuret of lead. It must not be supposed that sulphuretted hydrogen, when it has proved fatal in a *diluted* form, can be detected in the lungs, stomach, or blood of a dead body. When the body is recently removed from a drain or sewer, the gas may be found pervading the whole of the tissues; but in other cases it will be as useless to look for it as for carbonic acid in poisoning by this gas. Noxious gases are not long retained by the tissues; a short exposure will suffice to remove all traces of them. The examination of the locality can alone throw a light upon the cause of death. The proportion of the gas found in an apartment will, however, rarely be a criterion of the quantity which has destroyed life. A person going into a room where the deceased bodies are lying, may notice only a disagreeable or a stifling smell, but he may be able to breathe for a longer or shorter period with the door or window open. It is not the respiration of a few minutes, but the breathing of the diluted noxious atmosphere for many hours, that really destroys life. The best method of detecting sulphuretted hydrogen when present in a dead body (not putrefied) is to place a piece of card, glazed with lead, in the muscles or soft organs: it will sooner or later be tarnished and acquire a brown colour, if the gas be present.

Sulphuretted hydrogen may be proved to exist by the lead-test in the vapour of *hydrosulphate of ammonia* when mixed with air, and the presence of ammonia is indicated in the compound by its volatile alkaline reaction on test-paper — also by holding, in a vessel containing the vapour recently collected, a rod dipped in strong hydrochloric acid: the production of dense white fumes announces the formation of hydrochlorate of ammonia. The presence of this vapour in any mixture is at once indicated by introducing paper wetted with a solution of nitroprusside of sodium. The hydrosulphate produces with it a rich crimson colour: if sulphuretted hydrogen alone is present, the nitroprusside paper undergoes no change. It is a fact which cannot be too universally known that a candle will readily burn in a mixture of either of these gases with air which, if respired, would suffice to destroy life. ('Ann. d'Hyg.,' 1829, vol. 2, p. 69.) The candle-test should be applied with caution in places where these effluvia are collected and confined in sewers or close cesspools. When sulphuretted hydrogen is diffused in a proportion of about 7 per cent. with air it forms a dangerously explosive mixture.

It is worthy of remark that the air of a cesspool may be often respired with safety until the workmen commence removing the soil, when a large quantity of mephitic vapour may suddenly escape, which will lead to the immediate suffocation of all present. Several persons have been killed by trusting to the previous burning of a candle, in ignorance of this fact. In descending in order to render assistance to persons who are lifeless, the person should on these occasions, whether sulphuretted hydrogen or carbonic acid be the cause, make a moderate inspiration of pure air and hold his breath while in the noxious mixture. In an accident which occurred in Whitechapel, in August 1857, three men died speedily from breathing the vapour of an old sewer, and two others nearly lost their lives in attempting to assist them. The best plan for getting rid of the gas is by a free exposure of the locality, or by exciting active combustion in it. According to Parent-Duchâtelet, men can work in an atmosphere containing from 2 to 3 per cent. of sulphuretted hydrogen. The air of one of the principal sewers of Paris gave the following results, on analysis, in 100 parts:—Oxygen, 13·79; nitrogen, 81·21; carbonic acid, 2·01; sulphuretted hydrogen, 2·99.

Another gaseous mixture in the form of deoxidized air was found by Thénard in the sewers of Paris: it was composed, in 100 parts, of nitrogen 90, of oxygen 2, and of carbonic acid 4. Sometimes the carbonic acid is combined with ammonia, and then it may be regarded, chiefly, as a mixture of nitrogen holding diffused through it the vapour of carbonate of ammonia, which is sufficient to render it highly irritating to the mucous membrane of the eyes and nose. Its action on the human body when respired will be readily understood from its chemical composition. In its operation it is essentially negative, and destroys life by cutting off the access of oxygen. The small proportion of carbonic acid or of carbonate of ammonia existing in it cannot give rise to the asphyxia which so rapidly follows its inhalation. The chances of recovery are much greater in persons who become asphyxiated from the inspiration of this compound than in those who are exposed to the influence of the preceding. Commonly the immediate removal to a current of pure air is sufficient to bring about a recovery. Should death take place, it will be found on inspection that the internal appearances are the same as those which are met with in death from suffocation.

Analysis.—This compound has no offensive smell; it extinguishes a taper: the carbonic acid contained in it may be removed by caustic potash, and then it will be seen that the great bulk of the mixture is formed of nitrogen—a gas which, by its negative properties, cannot be easily confounded with any other. In a mixed atmosphere of carbonic acid and sulphuretted hydrogen, the two gases may be separated by agitating the mixture with a solution of acetate of lead, and treating the precipitate with acetic acid, which dissolves the carbonate and leaves sulphide of lead.

EXHALATIONS FROM THE DEAD.

It may be proper in this place to make a few remarks on the alleged danger of the exhalations given off by dead bodies in a state of putrescence. Formerly there existed a groundless fear relative to the examination of a putrefied dead body; and during the last century, on several important occasions, medical witnesses refused to examine the bodies of deceased persons who were presumed to have been murdered, alleging that it was an occupation which might be attended with serious consequences to themselves. Orfila has collected many accounts of the fatal effects which are recorded to have followed the removal of the dead some time after interment. ('Traité des Exhumations,' vol. 1, pp. 2 *et seq.*) He allows, however, that the details of most of these cases are exaggerated, and attributes to other causes the effects which followed. Indeed, the observations of Thouret and Fourcroy prove that these dangers are restricted within a narrow compass, and that in general with common precautions dead bodies may be disinterred, and transported from one locality to another, without any risk to those engaged in carrying on the exhumations. About the latter part of the last century from fifteen to twenty thousand bodies, in almost every stage of putrefaction, were removed from the Cimetière des Innocens in Paris; and the accidents that occurred during the operations, which lasted ten months, were comparatively speaking few. The workmen acknowledged to Fourcroy that it was only in removing the recently interred corpses, and those which were not far advanced in decomposition, that they incurred any danger. In these cases the abdomen appeared to be much distended with gaseous matter; if ruptured, the rupture commonly took place about the navel, and there issued a bloody fœtid liquid, accompanied by the evolution of a mephitic vapour—probably a mixture of carbonic acid and sulphuretted hydrogen. Those who respired this vapour, as it escaped from the body, fell instantly into a state of asphyxia and died; while others who were at a distance, and who consequently breathed it in a diluted state, were affected with nausea, giddiness, or fainting, lasting some hours, and followed by weakness and trembling of the limbs. Some years since, when it was the practice to bury the dead in the crowded churchyards of London, lives were frequently lost by reason of the noxious gases and effluvia which at once filled every grave as it was made. These gases were chiefly carbonic acid and sulphuretted hydrogen: they have been already fully described. A grave twenty feet deep was usually dug between strata of exposed coffins, and this grave was kept open until it was filled with bodies. In September 1838 two persons were killed by the effluvia which had collected in one of these deep graves kept open in Aldgate Churchyard. (See, in reference to this subject, Henke's 'Zeitschrift,' 1840, vol. 2, p. 446; 'Ann. d'Hyg.,' 1832, p. 216; 1840, p. 131; 1840, pp. 28, 32.)

In addition to these, there are other gases and vapours of a poisonous nature which are for the most part artificial products. It is seldom that individuals are exposed to respire them in such quantity as to cause serious symptoms or to endanger life.

LIGHTNING. COLD. HEAT. STARVATION.

CHAPTER 57.

LIGHTNING—EFFECTS OF THE ELECTRIC FLUID—CAUSE OF DEATH—POST-MORTEM APPEARANCES—CASES—LEGAL RELATIONS—COLD AN OCCASIONAL CAUSE OF DEATH—SYMPTOMS—CIRCUMSTANCES WHICH ACCELERATE DEATH—POST-MORTEM APPEARANCES—CASE OF MURDER BY COLD—EFFECT OF HEAT—STARVATION A RARE CAUSE OF DEATH—SYMPTOMS—APPEARANCES AFTER DEATH—LEGAL RELATIONS.

LIGHTNING.

Effects of the electric fluid.—Death by lightning is sufficiently common to require that a medical jurist should be prepared to understand the phenomena which accompany it: but there is a more important reason why he should devote some attention to this subject—that is, that the appearances left by the electric fluid on the human body sometimes closely resemble those produced by great mechanical violence. Thus a person may be found dead in an open field, or on the highway; his body may present the marks of contusion, laceration, or fracture; and to one unacquainted with the fact that such violence occasionally results from the effect of this subtle agent, it might appear that the deceased had been maltreated, and probably murdered. The greater number of deaths from the electric fluid take place during the spring and summer. According to one annual report, there were 24 deaths from lightning registered during the year, occurring in the following seasons:—Summer, 11; spring, 10; autumn, 2; winter, 1. Out of 103 deaths from lightning in five years (1852-56), there were 38 in the month of July and 22 in August.

Cause of death.—The electric fluid appears to act fatally by producing a violent shock to the brain and nervous system. In general there is no sense of pain; the individual falls at once into a state of unconsciousness. In a case which did not prove fatal, the person, who was seen soon after the accident, was found labouring under the following symptoms:—Insensibility; deep, slow, and interrupted respiration; entire relaxation of the muscular system; the pulse soft and slow; the pupils dilated, but sensible to light. ('Med. Gaz.,' vol. 14, p. 654.) It will be seen that these are the usual symptoms of concussion of the brain. The effect of a slight shock is that of producing stunning; and when persons who have been severely struck recover, they suffer from noises in the ears, paralysis, and other symptoms of nervous disorder. ('Med. Times,' July 15, 1848.) Insanity has even been known to follow a stroke of lightning. (Conolly's 'Report of Hanwell,' 1839.) In one case the person remained delirious for three days, and when he recovered he had completely lost his memory. ('Lancet,' August 3, 1839, p. 582.) A boy, æt. 4, received a severe shock on the 11th May, was seized with tetanus on the 13th, and died in four hours. ('Med. Times and Gaz.,' May 26, 1855.) In another instance an old man who took shelter under a tree felt as if a vivid flash had struck him in the face: he did not fall, but he became almost blind. He suffered for some days from frontal headache, and loss of sight supervened. ('Med. Times and Gaz.,' July 24, 1858.)

It may be observed of the effects of lightning, generally, that death is either immediate, or the individual recovers. A person may however linger, and die from the effects of severe lacerations or burns indirectly produced. A case occurred in this city, in July 1838, where death was thus caused indirectly by the effects of electricity. The following case of recovery illustrates further the action of the electric fluid:—Three persons were struck by lightning at the same time. In one, a healthy man, æt. 26, the symptoms were severe. An hour and a half after the stroke he lay completely unconscious, as if in a fit of apoplexy; his pulse was below 60, full and hard; his respiration snoring, his pupils dilated and insensible. There were frequent twitchings of the arms and hands; the thumbs were fixed and immovable, and the jaws firmly clenched. Severe spasms then came on, so that four men could scarcely hold the patient in his bed; and his body was drawn to the left side. When these symptoms had abated he was copiously bled; cold was applied to the head, a blister to the nape of the neck, and mustard-poultices to the legs. Stimulating injections and opium were also administered: in the course of twenty-four hours consciousness slowly returned, and the man soon completely recovered. The only external injury discoverable was a red streak, as broad as a finger, which extended from the left temple over the neck and chest: this disappeared completely in a few days. ('Brit. and For. Med. Rev.,' Oct. 1842.) These red streaks or marks sometimes assume a remarkable disposition over the skin. (See case by Dr. Horstmann, Casper's 'Vierteljahrsch.,' April 1863, p. 308.)

Appearances after death.—The suddenness of death is such that the body sometimes preserves the attitude in which it was struck. ('Med. Times and Gaz.,' Feb. 18, 1860, p. 167.) Generally speaking there are, externally, marks of contusion and laceration about the spot where the electric current has entered or passed out:—sometimes a severe lacerated wound has existed:—on other occasions there has been no wound or laceration, but an extensive ecchymosis, which, according to Meyer, is most commonly found on the skin of the back. In one instance, which occurred in London in May 1839, there were no marks of external violence; and several similar cases are quoted from American journals in the 'Medical Times' (May 3, 1845, p. 82). The clothes are in almost all cases rent and torn, and partially singed, giving rise to a peculiar odour,—sometimes even rolled up in shreds and carried to a distance. They are occasionally found partially burnt, but this is not a frequent occurrence. Metallic substances about the person present traces of fusion, and articles of steel have been observed to acquire magnetic polarity. Dr. West has informed me, that in a case to which he was called, in which a boy, æt. 18, had been instantly struck dead by lightning, he observed that a knife in the pocket of the deceased had acquired strong magnetic polarity. This case further shows that which has frequently been noticed—namely, that while much violence has been done to the dress, the parts of the body covered by it had escaped injury. The deceased wore at the time of the accident a pair of strong leather boots: these were torn to shreds, probably owing to the presence of iron nails in the soles, but the feet of the deceased presented no mark of injury! An accident by lightning occurred in the presence of a friend of mine, by which a healthy man was instantaneously killed. A cap which the man wore had a hole through it; his hair was singed, his shoes were burst open, and his trousers torn. The woodwork of the building down which the electric fluid passed was merely split, and there was no mark of burning. I have examined, in several instances, the wood of trees which have been struck by the electric fluid: in each case it has presented only the appearance of rending by mechanical force.

Wounds and burns are sometimes met with on the body. The wounds have commonly been lacerated punctures, like stabs produced by a blunt dagger. In the case of a person who was struck but not killed, a deep wound was produced in one thigh, almost laying bare the femoral artery. This person was struck, as many others have been, while in the act of opening an umbrella during a storm. Fractures of the bones have not been commonly observed: in a case mentioned by Pouillet, the skull was severely fractured, and the bones depressed. ('Traité de Physique, Elect. Atmosph.') In May 1864 Dr. Mackintosh, of Littleport, was called to see three persons who had been struck by lightning about *twenty minutes* previously. They had taken shelter under a haystack, which had been set on fire by the same flash. 1. A boy, aged 10, was then able to walk, although unable to move his legs immediately after the occurrence. All that he remembered was—he saw the stack on fire, and called to his father; he felt dizzy all over, and unable to move. His hair and clothes were not singed, and the metallic buttons on his dress showed no signs of fusion. On removing his clothes a slight odour of singeing was perceptible. He complained of pain at the lower part of the abdomen. There were several red streaks, of about a finger's breadth, running obliquely downwards and inwards on either side of the chest to the middle line in front of the abdomen; they then descended over the pubes, and were lost in the perineum. It does not appear that there was any abrasion of the skin. This boy perfectly recovered; the red streaks disappeared gradually, and could hardly be traced four days after the injury. 2. Another boy, aged 11, lay prostrate and unconscious, with an expression of grim terror and suffering; he frothed at the mouth, moaned piteously, and flung his legs and arms about in all directions. The respiration was deep, slow, and laborious; the heart palpitating, pulse weak and very irregular; the pupils were dilated, and insensible to light. There were in this case several red streaks converging from the neck and shoulders to the middle of the chest-bone, and passing over the abdomen until they were lost on the pubes. There were similar streaks radiating for a few inches from the tuber ischer on each hip in different directions, until they were lost in the skin. It appears that this boy was in a sitting posture when struck. The hair on the back of his head and neck was singed, and the peculiar odour of singeing was perceived, although his clothes showed no traces of burning, nor the metallic buttons of fusion. The boy became conscious in five hours, and rapidly recovered. The red streaks gradually disappeared, leaving streaks of a scaly glistening white appearance, which ultimately left no trace of their existence. 3. A man, aged 46. Like the two others, he was in a sitting posture, and he appeared to have been killed on the spot: he had not moved hand or foot. The countenance was placid, and the pupils were widely dilated. The electric fluid had produced a large *lacerated wound* of the scalp, at the junction of the occipital with the parietal bones, but without producing any fracture. The electric fluid appeared to have passed down each side of the head, between the soft parts and the cranium. On the left side it had passed downwards in front to the left ear, and terminated on the side of the neck, rupturing bloodvessels and muscles, and causing swelling of the parts with effusion of blood. It presented the appearance of an extensive bruise caused by mechanical violence. On the right side the current had passed down to the space above the collar-bone, causing lividity and swelling of the right ear as well as of the adjacent skin; and it terminated in a dark-blue mangled patch of skin, in which there were several free communications with the surface. The hair on the back of the head was slightly singed, and that in front of the chest was singed quite close to the skin, but the hair which covered the wound in the scalp, where the current had entered, was uninjured. The clothes were neither torn nor burnt, and the metallic buttons were not fused. The clothes of all three were very wet. The hat was not examined. The left side-pocket of the trousers contained several lucifer-matches and a tin tobacco-box, which were unaffected by the electric discharge. The right pocket contained a knife, which had acquired strong magnetic polarity. The body was placed in a warm room, and it is worthy of remark that cadaveric rigidity came on in fourteen hours after death. ('Lancet,' July 30, 1864, p. 118.) It is to be regretted that no post-mortem examination was allowed. It is probable that the brain sustained severe injury, causing immediate death. These cases singularly present the effects of lightning in three degrees—the effect of a slight shock in No. 1, of a severe shock in No. 2, and of a fatal shock in No. 3. There was but little bodily injury in either case, and no appearance of burning. The marks on the skin in Nos. 1 and 2 could not have been mistaken for violence, but the wound to the scalp and the injuries to the neck in Nos. 3 might have been ascribed to the violence of another, had not the circumstances been fully known. The clothes probably escaped burning or tearing by reason of their being wet, and their readily conducting the electric fluid.

The *burns* occasionally found on the bodies of persons who have been struck by lightning have been hitherto ascribed to the ignition of the clothes. It appears, however, from the subjoined cases, that burns even of a severe kind may be the result of a direct agency of the electric fluid itself upon the body. Dr. Geoghegan met with the case of a girl who had been struck by lightning: there was burning of the thigh and buttocks to the first and second degrees, but the clothes did not show any signs of combustion. I am indebted to Mr. Fisher, of Dudley, for a more detailed account of a case illustrating the same point. On the 16th of July 1852 a man, æt. 23, while engaged in milking a cow in a wooden shed, during a severe thunderstorm, suddenly observed a vivid flash of lightning, which killed the cow instantly, and inflicted serious injuries upon himself. Mr. Fisher saw him sixteen hours after the accident, and found a severe burn on his person, extending from the right hip to the shoulder, and covering a large portion of the front and side of the body. His mind was then wandering, and there were symptoms of inflammatory fever. The man was confined to his bed for seventeen days, at the end of which time the injuries had not perfectly healed. On examining his dress the right sleeve of his shirt was found burnt to shreds, but there was no material burning of any other part of the dress. The case is singular, inasmuch as it shows that the dress may be burnt without the surface of the body being simultaneously injured; and further, that a burn may be produced on the body, although the clothes covering the part may have escaped combustion. Mr. Fleming has described the cases of eight persons who were struck by lightning, and on the bodies of some of these there were marks of severe burns. The dresses were, in parts, much singed. These cases show, in a remarkable manner, the intense heat evolved in the instantaneous passage of the electric fluid through the clothes and body. The persons struck were benumbed or paralyzed in various degrees, but all ultimately recovered. The burns were so severe that some months elapsed before they were entirely healed. ('Glasgow Med. Journal,' Oct. 1859, p. 257.) A man was struck by lightning in July 1861: he was seen by Mr. Hill. Externally there was a burn upon the nape of the neck, where the metallic watchguard rested; and from the point where the current of electricity left the chain, the skin was blistered in a straight line down to the feet, scorching the hair of the pubes in its course. His intellect was confused, and his general condition was that of collapse. With the aid of stimulants he became sufficiently restored to communicate his feelings. There was paralysis of the lower extremities, with loss of sensibility (anæsthesia), and retention of urine. He was deaf, and complained of a noise in his ears like thunder; he had some difficulty in articulating, and pain in swallowing with a peculiar metallic taste in his mouth. The anæsthesia passed away in half-an-hour, but he did not completely recover the use of his limbs for four days; the bladder was paralyzed for twenty-four hours, and only relieved by the catheter of high-coloured urine with abundance of phosphates. The bowels were confined. All these symptoms gradually disappeared, excepting slight deafness, and he was discharged convalescent.

The following complete account of the external and internal appearances found in the body of a healthy middle-aged labourer, who was killed by a stroke of lightning, has been published by Dr. Schaffer :—The man was working in the fields with several other labourers, just after a thunderstorm had passed over and had apparently subsided. He was endeavouring to kindle a light with a flint and steel, when the lightning struck him. For a moment after the shock he stood still, and then fell heavily to the ground. The electric fluid entered at the upper part of his forehead, perforating and tearing his hat at that part : it seemed then to have become divided into two currents, which passed down the sides of the body, along the lower limbs and out at the feet. On the upper part of the forehead was found a soft swelling, of a dark-blue colour, and about the size of the palm of a hand : the hair which covered it was uninjured. From this spot two dark-red streaks proceeded in different directions. One of these passed to the left, running over the temple, in front of the left ear, down the neck to the surface of the chest, over which it passed between the left nipple and the armpit ; and so made its way over the body to the left inguinal region, where it formed a large, irregular, scorched-looking (brandige) patch on the skin. From this point the dark-red streak again continued its downward course, passing over the great trochanter, then along the outer surface of the left leg to the back of the foot, where it terminated in several small dark-blue spots. The other streak, which proceeded from the ecchymosed swelling on the forehead, passed directly to the right ear, which was considerably swollen and of a dark-blue colour : from the ear it ran downwards and backwards along the neck, crossed the right border of the scapula, and eventually reached the right groin, where a scorched patch of skin, similar to that in the left groin, was found. From this part the discoloured streak continued down the outer side of the right leg, to its termination on the back of the foot, just as on the left side. It is remarkable that although the hair on the forehead, as well as that which occurred in any part of the track taken by the electric current down to the groin, was not burnt, yet at the groin itself, and at every part hence to the foot over which the electric stream had passed, the hairs were completely burnt. The cause of the skin and hair in the groins being burnt is probably to be referred to the buckles of a belt which the man wore round his abdomen at the time of the accident : the belt was completely destroyed. Nothing further worthy of notice was observed on the exterior of the body, with the exception of the face being very red. The swelling of the head was found to be due to the presence of a large quantity of extravasated blood. The bone beneath was not injured. Blood was effused in other parts of the scalp corresponding to the swollen discoloured patches outside ; about four ounces had been effused. The vessels of the cerebral membranes were much congested, and the brain itself contained a large quantity of blood, especially the choroid plexuses. A large quantity of reddish mucus was found in the larynx, windpipe, and air-tubes. The lungs were loaded with dark blood ; there was a great deficiency of blood in the cavities of the heart and in the large vessels. The bloodvessels of the stomach and intestines were more than usually congested. The right lobe of the liver was of a dark-red colour, and loaded with blood, especially the part which corresponded to the burnt patch of skin at the lower part of the abdomen. The spleen also was large, and filled with blood. Much blood was found accumulated in the substance of the muscles of the abdomen, at those parts which lay beneath the burnt surfaces outside. (‘Oesterreich. Med. Wochenschrift,’ 6th June 1846.) It was formerly supposed that the blood was never found coagulated in persons killed by lightning, and that the body did not become rigid after death. From facts elsewhere related (pp. 18, 21), it will be perceived that these statements are not in accordance with observed facts.

In the case of an old man killed by lightning, the external surface of the body presented slight marks of violence, except the left ear, which was severely lacerated. On opening the head, the left hemisphere of the brain was found entirely disorganized, forming a homogeneous mass, almost liquid, of a greyish colour, and without a vestige of normal structure, except a small portion of the corpus striatum, which had retained its natural appearance and situation. The left lung was partly injured. The skin of the abdomen was marked by black longitudinal superficial lines. On the skin of the left ankle there was an ecchymosed spot, and at the point of the foot a deep wound. The hat and shoes of the deceased had been destroyed, but the rest of his clothes were uninjured. ('Heller's Journal,' Feb. 1845, p. 245.) The following appearances were found in the body of Professor *Richman*, who was killed at St. Petersburg, in 1753, while engaged in some experiments on atmospheric electricity:—On the left side of the forehead, where the deceased had been struck by the electric current, there was a round ecchymosed spot. There were eight other patches of ecchymosis, of variable size, extending from the neck to the hip, principally on the left side. Some of these, situated on the trunk, resembled the marks produced by gunpowder when discharged in contact with the skin. The left shoe was torn open at the buckle without being singed or burnt; but the skin around was slightly ecchymosed. Internally a quantity of blood was found extravasated in the windpipe, the lungs, and the layers of the omentum. The omentum presented the appearance of having been violently contused. (Murbach's 'Encyklopädie. Blitz;' also Henke's 'Zeitschrift der S. A.,' 1844, vol. 1, p. 193.)

Ranke has endeavoured to determine the relative conducting power of living muscle which constitutes so large a portion of the body. The conclusion at which he has arrived is that the conducting power of muscle in reference to electricity is three-million times weaker than that of mercury, and fifteen million times below that of copper. (Brown Séquard, 'Proc. R. S.,' No. 44.)

Legal relations.—Rare as the combination of circumstances must be in which a medico-legal question can arise in reference to the action of the electric fluid on the body, a case was tried in France, in October 1845, in which medical evidence respecting the characters of wounds caused by electricity was of considerable importance. In August of that year some buildings were destroyed at Malaunay near Rouen, as it was alleged, on the one side by a thunderstorm, on the other by a whirlwind; and as the parties were insured against lightning, they brought an action for recovering the amount insured. The evidence in favour of the accident having been due to electricity consisted,—first, in the alleged carbonized appearance of the leaves of some trees and shrubs growing near; and secondly, in the characters of the wounds on the bodies of several persons who were injured at the time of the occurrence. M. Lesauvage stated at the trial that there was an appearance of dark stains scattered over the bodies, and that those who survived, suffered from torpor, pains in the limbs, and a partial paralysis of motion. He observed, also, that decomposition took place very speedily in the bodies of those who were killed. In one instance the muscles were torn and lacerated, and some small arteries divided. This witness attributed most of the wounds to the effects of electricity. M. Funel deposed, that in some of the dead bodies which he examined the face and neck were bloated and discoloured, as if death had taken place from asphyxia. It does not appear, however, that there were any circumstances decisively proving that the buildings had been destroyed by lightning. M. Pouillet has given an accurate description of the storm: he believed that although, as deposed to by some of the witnesses at the trial, it may have been attended with thunder and lightning, the buildings with the surrounding trees were overthrown by the mere force of the wind, and not by the electric fluid. The description given bears out this view, but at the same time it is unusual that trees when struck, unless old or dry and withered, should present any marks of combustion about the leaves or trunk. (See 'Comptes Rendus,' Sept. 1845; also 'Med. Gaz.,' vol. 36, p. 1133.) The scientific evidence was of the most conflicting kind. The Royal Court of Rouen decided that the disaster was occasioned by the atmosphere; and, without entering into the various theories of storms, condemned the insurance companies to pay the amount claimed. ('Law Times,' March 14, 1846, p. 490.)

COLD.

Cause of death.—The protracted exposure of the human body to a low temperature may destroy life; and although in this country cases but rarely occur in which cold alone operates fatally, it is not unusual, during a severe winter, to hear of persons, in a state of misery and destitution, being found dead in exposed situations. On these occasions we may reasonably suspect that the want of proper food and nourishment has accelerated death. It is, however, convenient to make a distinction between the effects of cold and of starvation on the system, as the symptoms preceding death and the rapidity with which it takes place, are different in the two cases.

Symptoms.—A moderate degree of cold is well known to have an invigorating effect upon the body; but if the cold be severe, and the exposure to it long-continued, while the calorific function is not maintained by warmth of clothing or exercise, the skin becomes pale, and the muscles become gradually stiff and contract with difficulty, especially those of the face and extremities. Sensibility is lost, a state of torpor ensues, followed by profound sleep, from which the person cannot be readily roused: in this state of lethargy the vital functions gradually cease, and the person finally perishes. Such are the general effects of intense cold upon the body: its influence on the nervous system is seen in the numbness, torpor, and sleepiness which have been described as consequences of a long exposure to severe cold. Giddiness, dimness of sight, tetanus, and paralysis have in some cases preceded the fatal insensibility. It has been found that temperature materially affects the amount of oxygen taken by the blood. At a low temperature it takes less oxygen; hence the blood becomes less oxygenated, and this state of the blood affects the condition of the nervous system. (Bernard, op. cit., p. 114.) It was observed during the retreat of the French from Moscow, that those who were most severely affected by cold often reeled about as if in a state of intoxication; they also complained of giddiness and indistinctness of vision, and sank under a feeling of lassitude into a state of lethargic stupor, from which it was found impossible to rouse them. Sometimes the nervous system was at once affected: tetanic convulsions, followed by rigidity of the whole of the voluntary muscles, seized the individual, and he rapidly fell a victim. Symptoms indicative of a disturbance of the functions of the brain and nervous system have also been experienced by Arctic travellers during their residence within the Polar circle.

Circumstances which accelerate death.—There are certain conditions which may accelerate death from cold. In all cases in which there is exhaustion of the nervous system—as in those who are worn out by disease or fatigue, in the aged and infirm, or, lastly, in persons who are addicted to the use of intoxicating liquors—the fatal effects of cold are more rapidly manifested than in others who are healthy and temperate. It has been uniformly remarked that whenever the nervous energy is impaired, either by intoxication or exhaustion from fatigue, a man dies quickly from cold. The exposure of drunken persons, during a severe winter, may therefore suffice to destroy life, although the cold might not be so intense as to affect others who were temperate. Casualties of this nature sometimes occur during the winter-season in this metropolis; and a knowledge of the influence of intoxication, in accelerating death under such circumstances, may occasionally serve to remove a doubt in the mind of a practitioner respecting the real cause. Infants, especially when newly born, easily perish from exposure to cold. Cold, when accompanied by rain and sleet, appears to have a more powerfully depressing influence than when the air is dry,—probably from the effects of evaporation. The following case by Dr. Currie shows the fatal effects of cold winds accompanied by humidity:—'Of several persons who clung to a wreck, two sat on the only part that was not submerged; of the others, all were constantly immersed in the sea, and most of them up to the shoulders. Three only perished, two of whom were generally out of the sea, but frequently overwhelmed by the surge, and at other times exposed to heavy showers of sleet and snow, and to a high and piercing wind. Of these two, one died after four hours' exposure; the second died three hours later, although a strong healthy adult, and inured to cold and hardship: the third that perished was a weakly man. The remaining eleven, who had been more or less completely submerged, were taken from the wreck the next day, after twenty-three hours' exposure, and they recovered. The person among the whole who seemed to have suffered least was a negro: of the other survivors, several were by no means strong men, and most of them had been inured to the warm climate of Carolina.'

Appearances after death.—Opportunities rarely occur of examining bodies when death results purely from exposure to cold. The skin is commonly pallid, and the viscera of the chest and abdomen as well as the brain are congested with blood. Dr. Kellie, of Leith, found in two cases which he examined, a redness of the small intestines from the congestion of the capillary vessels, and a great effusion into the ventricles of the brain. A sufficient number of cases have not yet been inspected, to enable us to determine how far these two last-mentioned appearances are to be regarded as consequences of death from cold; but all observers have found a general congestion of the bloodvessels and viscera. In consequence of the great congestion uniformly met with in the vessels and sinuses of the brain, some pathologists have regarded death from cold as resulting from an attack of apoplexy; but the symptoms which precede death do not bear out this view. Effusions of blood have not yet been observed, and a mere fulness of the cerebral vessels after death is not in itself sufficient to justify this opinion. It will be observed that, on the whole, these appearances are remarkably similar to those which are found in death from severe burns and scalds. Thus then a medical jurist will perceive, that in order to come to a decision whether, on the discovery of a dead body, death has taken place from cold or not, is a task of some difficulty. The season of the year,—the place and circumstances under which the body of the deceased is found,—together with the absence of all other possible causes of death (such as from violent injuries or internal disease), form the only basis for a medical opinion. Death from cold is not to be determined except by negative or presumptive evidence; for there is no organic change, either externally or internally, sufficiently characteristic of it to enable a medical man to give a positive opinion on the subject.

Case of murder by cold.—The following case involved the question of the atal effects of cold upon the body. A man and his wife, residing at Lyons, were tried for the murder of their daughter, a girl aged 11, under the following circumstances:—On the 28th December, at a time when there was a severe degree of cold, the female prisoner compelled the deceased to get out of her bed, and place herself in a vessel of ice-cold water. The child cried and endeavoured to escape from the bath, but she was by violence compelled to remain in the water. The deceased soon complained of exhaustion and dimness of sight: the prisoner then threw a pail of iced water upon her head, soon after which the child expired. Death was properly ascribed to the effects of this maltreatment, and the woman was convicted. ('Ann. d'Hyg.' 1831, p. 207: see also 'Med. Times and Gazette,' July 21, 1860, p. 61.) This case presents a refinement of cruelty which is rarely met with in the annals of crime. Such a case could only be proved by circumstances; for there would be no appearances in the body, internally or externally, to indicate the mode of death. We learn by this that the death of infants or children may be caused by the external application of cold liquids to the skin, coupled with exposure. It would also appear, from this case, that the brain and nervous system are sympathetically affected through the skin and not through the introduction of cold air into the lungs. Indeed it is well known, from the experience of Arctic travellers, that air of a temperature considerably below zero may be respired without risk, provided the skin be kept warm.

In *Reg.* v. *Lovell* (Gloucester Lent Assizes, 1853) a woman was convicted of the manslaughter of a child aged four years. The child it seems was in a diseased condition, and the prisoner, during the month of January, placed her under a pump in the yard, and turned the cold water upon her. The medical witness did not consider that this accelerated death, but the jury returned a verdict of guilty; and on passing sentence the late Mr. Justice Talfourd observed, that the verdict was based on common-sense and reason, although against the opinion of the medical witness!

HEAT.

Intense heat. — The effect of an intensely heated atmosphere in causing death has been but little studied. I have been consulted in one case in which the captain of a vessel was charged with manslaughter, for causing a man to be lashed within a short distance of the stoke-hole of a steam-furnace in the hold of a vessel. The man died apparently from the effects of this exposure. The engine-rooms of steamers in the tropics have been observed to have a temperature as high as 140°; and engineers after a time become habituated to this excessive heat, without appearing to suffer materially in health. In the Turkish-bath higher temperatures than this have been noted, but there is reason to believe that serious symptoms have been occasionally produced in persons unaccustomed to them, and that in one or two cases death has resulted. In attempting to breathe air heated to temperatures varying from 180° to 200°, there is a sense of suffocation with a feeling of dizziness and other symptoms indicative of an effect on the brain: the circulation is enormously quickened.

In July 1861 an inquest was held in London on the body of a stoker of an Aberdeen steamship. He had been by trade a grocer, and was not accustomed to excessive heat. While occupied before the engine-furnace he was observed to fall suddenly on the floor in a state of insensibility; when carried on deck it was found that he was dead. All that was discovered on a post-mortem examination was an effusion of serum into the ventricles of the brain: death had been caused by sudden apoplexy. It is probable that excessive heat generally operates fatally by producing apoplexy. In some cases a person may sink from exhaustion as a result of long exposure.

STARVATION.

A rare cause of death.—Death from the mere privation of food is a rare event, although, if we were to form an opinion from the verdicts of coroners' juries, its occurrence would not appear to be uncommon in this and other large cities. In one of the Annual Registration Returns it is stated that 130 persons died from starvation. Such cases must, however, be received with some distrust, as care is rarely taken to ascertain precisely how far bodily disease may have been concerned in causing death. Still it cannot be denied that starvation should be classed among the forms of violent death, being sometimes the result of criminal neglect or inattention in the treatment of children or of infirm and decrepid persons, and thus constituting homicide; or at other times, although rarely, arising from an obstinate determination to commit suicide in those from whom all other means of self-destruction are cut off.

Symptoms.—The symptoms which attend on protracted abstinence are thus described by Rostan and Orfila:—In the first instance pain is felt in the stomach, which is relieved by pressure. The countenance becomes pale and livid or cadaverous; the eyes are wild and glistening, the breath hot, the mouth dry and parched, the saliva thick and sparingly secreted. An intolerable thirst supervenes, which, in all cases of attempted suicide by starvation, or privation of food from accident, has formed the most prominent symptom. The body becomes slowly emaciated, the eyes and cheeks sink, and the prominences of the bones are perceptible: the feeling of pain may be so intense as to give rise to delirium. There is the most complete prostration of strength, which renders a person incapable of the least exertion. After a longer or shorter period the body exhales a fœtid odour, the mucous membrane of the outlets becomes sometimes red and inflamed; and death may be preceded by a fit of delirium, or by convulsions ('Cours Elémentaire d'Hygiène,' vol. 1, pp. 283 *et seq.*; and Orfila, 'Médecine Légale,' vol. 1, p. 415). The symptoms of violent excitement described by these writers have been chiefly witnessed in the cases of shipwrecked mariners, and they may have been partly due to the peculiar effects of a tropical climate (Orfila, 'Méd. Lég.' vol. 1, p. 415), or to the drinking of wine, spirits, salt water, or even their own urine (Dr. Martyn, in 'Med. Times and Gazette,' March 30, 1861, p. 344). Referring to cases which occurred during the Irish famine of 1847, Dr. Donovan states that the persons who suffered, described the pain of hunger as at first very acute, but said that after twenty-four hours had been passed without food the pain subsided, and was succeeded by a feeling of weakness and sinking, experienced principally in the region of the stomach; accompanied with insatiable thirst, a strong desire for cold water, and a distressing feeling of coldness over the entire surface of the body. In a short time the face and limbs became frightfully emaciated; the eyes acquired a peculiar stare; the skin exhaled an offensive smell, and was covered with a brownish filthy-looking coating, almost as indelible as varnish. This he was at first inclined to regard as encrusted filth, but further experience convinced him that it was a secretion poured out from the exhalants on the surface of the body. The sufferer tottered in walking, like a drunken man: his voice was weak, like that of a person affected with cholera; he whined like a child, and burst into tears on the slightest occasion. In respect to the mental faculties, their prostration kept pace with the general wreck of bodily power; in many there was a state of imbecility, in some almost complete idiocy; but in no instance was there delirium or mania, which has been described as a symptom of protracted abstinence among shipwrecked mariners. ('Dub. Med. Press,' February 1848, p. 67.)

In addition to the symptoms above described, Orfila describes the existence of severe pain in the region of the stomach, a suppression of the fæces, or, if discharged, they are in small quantity, dry, and dark-coloured; the urine is scanty, high-coloured, and turbid; the intellect is dull. The person may be exhausted, and remain without motion in one position, or be seized with a furious delirium, which may drive him to acts of violence. In the last stage the body is reduced to an extreme state of emaciation, and before death it evolves an offensive odour, like that of incipient putrefaction. The excretions have also a putrescent odour. The surface of the skin may be covered with spots (petechiæ), and the person finally dies, in some cases slightly convulsed. (Op. cit. p. 415.) M. Chassat found, in his experiments on animals, that in some instances the animal died after having had successive attacks of convulsions. (Beck's 'Med. Jur.' vol. 2, p. 80.) In a case which fell under the notice of Dr. Sloan, a healthy man, æt. 65, was by an accident shut up in a coal-mine for twenty-three days without food. When found he was conscious, and he recognized and named his deliverers. He was so weak that he could scarcely raise his hand to his mouth, and so much emaciated as to excite the surprise of his fellow-workmen by the extreme lightness of his body. Under careful treatment he so far recovered as to give an account of his feelings. For the first two days hunger was his most urgent symptom. This passed off, and he then began to suffer from severe thirst, which he allayed by drinking some foul water. After ten days he became so weak that he was unable to move from the spot where he had lain down. He slept but little, and not soundly—never entirely losing the consciousness of his situation. His bowels acted only once, but he passed urine freely. The matter brought from his bowels by injections was dark-coloured, like meconium, and very fœtid. He died on the third day after his removal, in spite of every effort to save him, and on the day of his death he was in the following state:—his features were sharp and pale, his eyes sunk; the skin of the abdomen seemed to touch the backbone, which could be distinctly felt through it; his body presented more emaciation than Dr. Sloan had ever seen produced by disease; he had altogether a dried appearance, very much like that of natural mummies found in catacombs; his pulse was gone; his voice was in a whisper, like the *vox cholerica*; there was uneasiness, increased by pressure in the region of the stomach; his intellect was sound, and remained so until death. ('Med. Gaz.' vol. 17, p. 265.) This case confirms the observation of Dr. Donovan, that delirium is not a necessary attendant on protracted abstinence; and it proves incontestably that a person may die from the effects of abstinence or starvation, in spite of the best-directed efforts for recovery. Mr. Thornhill reports, in the same journal, the cases of eight men and a boy who were shut up in a coal-mine for eight days without food ('Med. Gaz.' vol. 17, p. 390); but the symptoms here noted were rather those of hunger than of long abstinence. They all suffered from excessive thirst; they were all troubled with ocular illusions, showing cerebral excitement. The occurrence of ocular spectra, and other symptoms indicative of a depressed state of the nervous system, has also been noticed by Casper. ('Handbuch der. Ger. Med.' 1857, vol. 1, p. 374.) According to Dr. Martin, the emaciation in starvation is characteristic; it is a withering or shrivelling-up of the skin, which has lost its elasticity, giving to youth the aspect of age. Death, when not hastened by disease, is slow and imperceptible, or it is precipitated by syncope from sudden effort, or by exposure to severe cold. Delirium is not, according to him, a symptom of starvation. ('Med. Times and Gaz.' March 30, 1861, p. 344.) The period which it requires for an individual to perish from hunger is subject to variation: it will depend materially upon the fact whether a person has had it in his power or not to take at intervals a portion of liquid, to relieve the overpowering thirst which is commonly experienced. The smallest portion of liquid, thus taken occasionally, is found to be capable of prolonging life. It is probable that in a healthy person, under perfect abstinence, death would not commonly take place in a shorter period than a week or ten days. This opinion appears to derive support from the results of those cases in which there has been abstinence owing to disease in the throat and difficulty of swallowing food. Age, sex, state of health, and the effects of exposure to cold, may accelerate or retard a fatal termination.

Appearances after death.—There are but few details of the appearances presented by the bodies of those who have died of starvation, and the cases themselves are too rare to enable us to decide with certainty upon the accuracy of the reports which have hitherto appeared on the subject. The body is shrunk and emaciated, and remarkable for its lightness. The skin is dry, shrivelled, and free from fat. The muscles are soft, deprived of fat, and much reduced in size. The stomach and intestines are usually found collapsed, contracted, and empty,—the mucous membrane being thinned and sometimes ulcerated. The liver, lungs, heart, kidneys, and the great vessels connected with these organs are collapsed and destitute of blood; the heart and kidneys free from any surrounding fat—the gall-bladder distended with bile—the omentum shrunk and destitute of fat. In Dr. Sloan's case (*supra*) the body was observed to be extremely emaciated: the intestines were collapsed, the stomach was distended with air, and slightly reddened at its greater extremity. The omentum had almost disappeared: it was entirely destitute of fat. The liver was small, and the gall-bladder distended with bile. The other viscera were in their normal state. ('Med. Gaz.' vol. 17, p. 389.) Mr. Tomkins, of Yeovil, inspected the body of a man who died from starvation in February 1838. The face was much shrunk and emaciated; the eyes were open, and presented a fiery red appearance, as intense as in a case of acute ophthalmia during life. This red appearance has been met with with by Dr. Donovan in death from exposure to cold. ('Dublin Med. Press,' Feb. 2, 1848, p. 66.) The skin was tough, and there was scarcely any cellular membrane to be seen. The tongue, lips, and throat were dry and rough. A peculiar odour was exhaled from the body. The lungs were shrunk and contracted; the investing membrane was slightly inflamed. The stomach and intestines were empty, but quite healthy; the gall-bladder was nearly full of bile, and the surrounding parts were much tinged by this liquid. The urinary bladder was empty and contracted. ('Lancet,' March 1838.) In some cases inspected during the Irish famine, Dr. Donovan states that the appearances which he witnessed were extreme emaciation, total absorption of the fatty matter on the surface of the body, total disappearance of the omentum, and a peculiarly thin condition of the small intestines, which in such cases were so transparent, that if the deceased had taken any food immediately before death, the contents could be seen through the coats of the bowel: on one occasion (at an inquest) he was able to recognize a portion of raw green cabbage in the duodenum of a man who had died of starvation. This thin condition of the coats of the intestines he looks upon as the strongest proof of starvation. The gall-bladder was usually full, and the parts in the vicinity of it were much tinged by the cadaveric exudation of bile; the urinary bladder was generally contracted and empty, and the heart pale, soft, and flabby; there was no abnormal appearance in the brain or lungs. Dr. Martyn assigns as a condition of the intestines diagnostic of starvation, that they are not only contracted but shrunken and diminished in size, shortened in length as well as in calibre, and like a mere cord, as if the canal was obliterated. ('Med. Times and Gazette,' March 30, 1851.) He met with this state in three cases: once in starvation from want of food, and twice from total obstruction to its ingestion. Mr. Fletcher found the following appearances in the cases of two children, named *Aspinall*, who died from starvation—the elder aged one year and ten months, the younger four months. In the body of the elder there was extreme emaciation, without the slightest trace of disease in any of the viscera. Some dirty creamy fluid and four cherry-stones were found in the small intestines, but no distinctly fæcal matter, a few grains of which, however, were found in the large intestines: scarcely a trace of fat was visible. In the infant the same appearances were presented, although the emaciation had not proceeded to the same extent. The evidence produced on the trial proved that the mother spent in drink the money given to her for household expenses, and that the children's food and clothing were neglected. The prisoners were tried for wilful murder, in accordance with the verdict of the coroner's jury. The judge ruled that the wife was in law the husband's servant, and if it were proved that he had supplied her with sufficient money, he must be acquitted; if he had not, the wife must be acquitted. The jury acquitted the man and brought in a verdict of manslaughter against the woman, who was sentenced to two years' imprisonment. ('Proceedings of Liverpool Medical Society,' 1855–56.) In some of these alleged deaths by starvation, ulceration of the bowels is met with. This has been considered to arise from want of food; but Dr. Donovan did not meet with it in those who died of lingering starvation. ('Dublin Med. Press,' Feb. 2, 1848, p. 66.)

These appearances, in order to throw any light upon the cause of death, should be accompanied by an otherwise healthy state of the body; since, as it is well known, they may be produced by many organic diseases, and death may be thus due to disease, and not to the mere privation of food. It will not, be always easy to say whether the emaciation depends on disease or want of food, unless we are put in possession of a complete history of the case. On this account, in all charges of homicidal starvation, the defence generally turns upon the coexistence of disease in the body, and the sufficiency of this to account for death. (See, in reference to medical evidence on this subject, the case of the *Queen* v. *Pryke*, Chelmsford Summer Assizes, 1840.)

The difficulties connected with medical evidence of death from starvation were well illustrated in *Reg.* v. *Mitchell* (Oxford Lent Assizes, 1861). The accused, a naval surgeon, was charged with the manslaughter of his female servant, a woman, æt. 24, by withholding from her sufficient food. The evidence entirely failed to support this charge, although there could be no doubt that deceased had died either from an insufficient supply of food, or from the fact that the food which she had taken, or had it in her power to take, was not adequate to support life. The medical facts of the case were communicated to me by one of the principal witnesses for the prosecution, who saw deceased for the first time on the 4th of January. He found the woman feeble, emaciated, and suffering from exhaustion: she complained of great weakness and giddiness. There was no natural disease to which these symptoms could be referred. In spite of her removal, and the use of stimulants, she died in five days (Jan. 9). On inspection there were no appearances to account for death from natural causes. The body was much emaciated, and so light that it weighed only fifty pounds; there was no fat. The intestines were thin, and transparent in parts; the stomach and small intestines were much contracted. There was an entire absence of fat from the omentum and mesentery: the gall-bladder was much distended with bile. The other organs of the body were healthy, and there was no disease in any part to account for the emaciation. Two medical gentlemen confirmed this evidence at the trial, and they all agreed that the appearances were consistent either with death from starvation or insufficiency of food, or with the non-assimilation of food. It was suggested in defence that deceased might have died from chronic diarrhœa; but there was no proof that this had existed to a degree to account for her death, and during the last five days of her life it was proved that she did not suffer from diarrhœa at all. The statement of the deceased went to show that food was not withheld from her, and the prisoner was properly acquitted. The cause of death is, however, a separate question from his alleged criminality. On this point there is no reason to doubt that the opinion given by the three medical witnesses was perfectly correct, and justified by the facts which they observed. The symptoms and appearances, as well as the entire absence of any natural disease to account for them, lead to the conclusion that deceased could not have taken sufficient food to support life, or that that which she took was not properly assimilated: in either case the symptoms and appearances would be those of death from protracted abstinence or starvation. As she was of a scrofulous habit, and of weak constitution, and the weather at the time she was first seen had been remarkably cold, it is probable that these indirect causes aggravated in some degree the effects of insufficient nutriment. It was suggested that this could not have been a case of death from starvation, because, on the day before her death, the deceased became delirious; and delirium, it was alleged, is not a symptom of starvation. This may be true of some cases; but the occurrence of delirium in this instance was not sufficient to set aside the strong evidence furnished by the symptoms and the general condition of the body of deceased. Delirium may be the result of great bodily weakness, on whatever cause depending: it is probably more rare in cases of chronic diarrhœa than in those of protracted abstinence. Too much importance must not be attached to its presence or absence on these occasions, since experience shows that there are few cases of starvation accurately observed in which the symptoms have been strictly accordant: and it would be going too far to assert that the occurrence of delirium before death would justify a medical witness in asserting that death could not have been caused by starvation, when the condition of the body and the whole history of the case allowed of no other reasonable interpretation of the facts.

Legal relations.—Starvation is commonly the result of *accident* or *homicide*; but this is a question purely for the decision of a jury—it can seldom be elucidated by medical evidence. The withholding of food from an infant forms a case of homicide by starvation, on which a medical opinion may be occasionally required. Mr. Baron Gurney held that the *mother*, and not the father, was bound to supply sustenance to an infant. The child in this case was ten weeks old, and the father was charged with wilful murder, on the ground that he had not supplied it with food. The grand jury ignored the bill, under the instructions of the judge, upon the ground above stated. (The *King* v. *Davey*, Exeter Lent Assizes, 1835.) But it is probable that there were particular circumstances in the case which led to this decision. The facts may be of such a nature as to inculpate the father, by proving that he was accessory to the death of the child. But where the husband and wife were charged with the murder of an apprentice to the husband, by using him in a barbarous manner, and the opinion of the medical witness was that the boy had died from debility occasioned by the want of proper nourishment, it was held that the wife was entitled to be acquitted, as it was the duty of the *husband*, and not of the wife, to provide sufficient food and nourishment for the apprentice. (The *King* v. *Squire*, Starkie, vol. 2, p. 947.) Starvation is rare as an act of homicide, but it must not be supposed that the law implies by this the absolute deprivation of food; for if that which is furnished to a person be insufficient in quantity, or of *improper quality*, and death be a consequence, malice being at the same time proved, then the offender equally subjects himself to a charge of murder. Not many years since a woman, who was accustomed to take parish-apprentices, was tried and convicted of the murder of two children, who had died in consequence of the bad quality and small quantity of food furnished to them by the prisoner.

PREGNANCY.

CHAPTER 58.

SIGNS OF PREGNANCY—SUPPRESSION OF THE MENSES—PROMINENCE OF THE ABDOMEN—CHANGES IN THE BREASTS—QUICKENING—SOUNDS OF THE FŒTAL HEART—CHANGES IN THE MOUTH AND NECK OF THE UTERUS—FEIGNED PREGNANCY—DE VENTRE INSPICIENDO—PLEA OF PREGNANCY IN BAR OF EXECUTION—THE JURY OF MATRONS—CONCEALMENT OF PREGNANCY—PREGNANCY IN THE DEAD—IMPREGNATION IN A STATE OF UNCONSCIOUSNESS.

THE subject of Pregnancy, in so far as the proofs of this condition in a *living* female are concerned, rarely demands the attention of a medical jurist. If we except the few instances in which a magistrate requires an opinion from a medical man respecting the pregnancy of a pauper female brought before him, there are only two cases in the *English* law in which pregnancy requires to be verified; and these so seldom present themselves, that the questions connected with the pregnant state rather belong to the science than the practice of medical jurisprudence.

SIGNS OF PREGNANCY.

Suppression of the menses.—It is well known that in the greater number of healthy females, so soon as conception has taken place, this secretion is arrested. But there are certain abnormal conditions which must not be overlooked. There are some cases recorded which show that women in whom the menses have never appeared may become pregnant. This, however, is allowed by all accoucheurs to be rare; and when it occurs, which we may readily learn from the account of the woman, it will be necessary to search for other signs in order to determine the question of pregnancy. Irregularity as to the period at which the function takes place is common among females. This irregularity may depend either upon the age of the person, or upon disease, either of which causes it will not be difficult to recognize. Their continuance after conception may make a pregnancy appear short. A case is reported in which a woman was married in the summer of 1856, and the menses continued after as before marriage. In October 1857 they ceased for the first time, and in the following December the female was delivered of a full-grown child. The abdomen was not much enlarged, and the woman thought that she was only two months pregnant. ('Med. Times and Gaz.,' April 30, 1859.) It is well known that there are numerous disorders of the uterus under which, irrespective of pregnancy, the menses may become suppressed. The continuance of the menstrual discharge, when once set up, is not a necessary condition for impregnation. Dr. Murphy has reported the case of a woman who for sixteen years went on bearing children, eight in number, without having had during that period any appearance of the menses. The late Dr. Reid, who quotes this case, mentions five instances that fell within his own knowledge in which females became pregnant notwithstanding a long previous cessation of the discharge. ('Lancet,' September 10, 1853, p. 236.) The absence of the menses as a consequence of pregnancy is generally indicated by the good health which a female enjoys: and although disease may coincide with pregnancy, yet a careful practitioner will be able to estimate from the symptoms to which cause the suppression is due. On the other hand, a discharge perfectly analogous to the menstrual sometimes manifests itself, not merely for several periods in a pregnant woman, but during the whole course of pregnancy. (Dr. Murphy's 'Obstetric Report,' 1844, p. 9; also Henke's 'Zeitschrift der S. A.,' 1844, p. 265.) Mr. Whitehead has collected seven well-marked instances of menstruation during pregnancy. ('On Abortion,' p. 218.) These facts show that we must be cautious in forming an opinion; and not assert that, because a discharge continues, pregnancy cannot possibly exist, or, because there is no discharge, a female must be pregnant. The retention of the menses within the uterus from any cause, may produce enlargement of the abdomen, and give rise to most of the symptoms of pregnancy.

Feigned menstruation.—The menses may be either suppressed or retained; but if there be any strong motive for the concealment of her condition, a woman may feign menstruation. Dr. Montgomery detected a case of this kind, by the examination of the areolæ of the breasts. The woman had stained her linen with blood in order to make it appear that the menses continued, but she subsequently admitted that this was an imposition. It has been stated that there are differences between menstrual and ordinary blood, but there are no certain chemical means of distinguishing them. (See *ante*, p. 453.)

Prominence of the abdomen.—A gradual and progressive enlargement of the abdomen is a well-marked character of pregnancy: the skin becomes stretched, and the navel almost obliterated. This enlargement in general begins to be obvious about the third month, although there are some women of peculiar structure in whom the enlargement may not become perceptible until the fifth or sixth month, or even later: still it may be detected on examination. In fact, this sign can never be absent in pregnancy, although it may not be so apparent in some females as it is in others. The objection which exists to it is, that numerous morbid causes may give rise to prominence of the abdomen. This is undoubtedly the fact, as we have occasion to witness in the various kinds of dropsy, or in suppressed and retained menses—diseases which, in several instances, have been mistaken for pregnancy by eminent practitioners. On the other hand, instances are not wanting in which, owing to the persistence of menstruation and the absence of quickening, the gravid uterus has been actually tapped by mistake for an ovarian tumour: the operation being speedily followed by the birth of a full-grown child! (Whitehead 'On Abortion,' p. 186;) but the history of a case will in general enable a practitioner to form an opinion. A case of suppressed menstruation, strongly simulating pregnancy, is reported by Dr. Rüttel. (Henke's 'Zeitschrift,' 1844, p. 240.) The enlargement may be owing to disease—1st, when it has been observed by a female for a time longer than the whole period of gestation; 2ndly, when it has been accompanied by a generally diseased condition of the system; and 3rdly, when there is an absence of the other symptoms of pregnancy. The most embarrassing cases are unquestionably those in which abdominal disease coexists with pregnancy. In some of these time alone can solve the question, and a medical jurist should give the benefit of a doubt to the side of chastity, mercy, and humanity. (On an important case in which an abdominal tumour was mistaken for pregnancy, see 'Lancet,' October 16, 1847, p. 408.) While the abdomen enlarges from pregnancy, the margins of the abdominal muscles become more clearly defined; the navel is less depressed, and gradually acquires the level of the surrounding skin. As pregnancy advances it becomes more prominent, and in the last month it assumes the character of a tumour, instead of a depression. (Whitehead, op. cit. p. 209.)

A change in the breasts.—These organs in a pregnant woman are full and prominent, and the areolæ around the nipples undergo changes of colour which Dr. Montgomery and others regard as highly characteristic of the pregnant state. A mere fulness or pain in the breasts, and even in some rare instances the secretion of milk, may arise from other causes than pregnancy. Severe uterine or ovarian irritation may cause the breasts to become painful and swollen. The fulness of the breasts from pregnancy is not commonly observable until about the second or third month. A more or less transparent fluid is secreted by the gland-tissue of the breast, and can be expressed from the nipples. This secretion of milk may occur in a non-pregnant female as a result of uterine or ovarian diseases. These cases, however, are not very common; but after a woman has once secreted milk, the secretion is easily reproduced in the breasts by very slight causes, quite independently of pregnancy.

The *areola* is generally observed during pregnancy to become considerably darker in colour and larger in diameter. The skin of which the areola is formed is soft, moist, and slightly tumid. The little glandular follicles about it are prominent, and often bedewed with a secretion; the change of *colour* has been the most attended to. The areolæ are commonly well marked in from the second to the fourth month of pregnancy—the intensity of colour being the last condition of the areola to appear. The prominence of the glandular follicles does not always exist in pregnancy, and the areola may become large and dark-coloured from other causes: consequently these signs are only to be looked upon as corroborative. In females of dark complexion, the areolæ are naturally dark irrespective of pregnancy; and in some advanced cases these changes in the areolæ are entirely absent. ('Edin. Month. Jour.,' March 1848, p. 693.) Dr. Montgomery has described as a sign of pregnancy the existence of a *brown line* extending from the pubes to the navel, especially in females of dark complexion, and a dark-coloured but not raised areola of about a quarter of an inch in breadth around the navel; but this also may be produced by uterine or ovarian disease.

Quickening.—The signs above given are applicable to the early as well as to the late stages of utero-gestation; but that which we have here to consider is one which is rarely manifested until about the fourth or fifth month. Quickening is the name applied to peculiar sensations experienced by a female about this stage of pregnancy. The symptoms are popularly ascribed to the first perception of the movements of the fœtus, which occur when the uterus begins to rise out of the pelvis; and to these movements, as well as probably to a change of position in the uterus, the sensation is perhaps really due. The movements of the fœtus are perceptible to the mother before they are made evident by an external examination. The term is derived from the old Saxon word 'quick,' signifying living; as, at the time when medical science was in its infancy, it was considered that the fœtus only received vitality when the mother experienced the sensation of its motion! On the occurrence of quickening there is generally a great disturbance of the system, indicated by syncope, nausea, and other distressing symptoms. After a short time the female recovers; and if sickness has hitherto attended the pregnant state, it has been frequently observed to disappear when the period of quickening has passed.

No evidence but that of the female can satisfactorily establish the fact of quickening, and this it is necessary to bear in mind; since, in some cases in which pregnancy is an object of medico-legal importance, proof of quickening may be demanded by law. Dr. Reid remarks ('Lancet,' September 10, 1853,

p. 237), with respect to this sign, that few women can tell the exact day on which they first feel it; and a large proportion cannot place it within a range of fourteen days, which is of little assistance in the calculation of the probable date of delivery. Women who profess to be most exact in noting the period of quickening differ from each other as to the time. There is much self-deception as to this symptom. The discovery of the movements of a child by an examiner is really a proof that the usual period of quickening is past, but their non-discovery at the time of examination is no proof whatever that the woman has not quickened; since the movements are by no means constant, and may be accidentally suspended even at several successive examinations. Besides, cases every now and then occur in which well-formed healthy females do not experience the sensation of quickening during the whole course of pregnancy; and, what is of more importance, the movements of the child may be at no time perceptible to the examiner. The uncertainty of quickening as a sign of pregnancy is too well known to require more than adverting to. Females have been known to mistake other sensations for it, and in the end it has been proved that they were not pregnant. A woman may declare that she has felt quickening when she has not: and unless the movements of the child are perceived by the examiner at the time, how is he to confirm or disprove her statement? Quickening, then (so far as it concerns the statement of the female), cannot be relied on as a proof of pregnancy; but if the movements of the child can be felt by the examiner through the abdomen, this is clear evidence not only of the woman being pregnant, but of her having passed the period of quickening.

We may next consider the *period* of pregnancy at which this symptom ordinarily occurs. Our law seems to infer that it is a constant, uniform, and well-marked distinction of the pregnant state, and in some instances it insists upon proof accordingly. Taking the general experience of accoucheurs, quickening happens from the tenth to the twenty-fifth week of pregnancy; but the greater number of instances occur between the *twelfth* and *sixteenth* week, or between the fourteenth and eigthteenth week after the last menstruation. The late Dr. Reid considered it to denote about the sixteenth, seventeenth, or eighteenth week of pregnancy. The date corresponds to the termination of the fourth calendar month. One of his patients did not feel this symptom until the seventh calendar month. ('Lancet,' September 10, 1853.) It is a popular opinion that quickening takes place exactly at the end of four calendar months and a half, but it mostly occurs two or three weeks earlier than this period. Many females estimate that they are four months advanced in pregnancy when they quicken, but this mode of calculation is open to numerous fallacies. Dr. Rodrigue knew a lady who invariably quickened at two months, and went full seven months after, with all her children—five in number. ('Amer. Jour. Med. Sci.,' Oct. 1845, p. 339.)

From these observations, it will be seen that an examiner may sometimes detect the *movements of the child* about the third or fourth month, at others not until the fifth or sixth, and in other instances not at all throughout pregnancy. Even in those cases in which the movements of the child have ndisputably existed, they are not always to be perceived; hence several examinations should be resorted to, before any opinion can be fairly expressed from their absence. The best mode of examining the abdomen for fœtal movements is to allow the hand to remain at rest on the abdomen. If the patient has quickened recently, the impulse is slight, and generally at only ne spot, which, however, is seldom the same. Should she have advanced urther, then the movements will be more rolling, and the parts of the child be detected at the same time. In making these examinations a diagnosis may be facilitated by previously immersing the hand in cold water, and then suddenly applying it to the abdomen. When the movements of the child are distinctly perceived through the skin of the abdomen, they constitute a certain sign of pregnancy; but their non-discovery at a particular time is no proof that a female is not pregnant. The jury of matrons probably trust to this sign; hence their verdicts commonly turn out to be erroneous. There is another source of fallacy which may present itself when an artful woman is desirous of making it appear that she is pregnant—namely, that a woman may simulate the movements of a child by a peculiar action of the abdominal muscles. Medical practitioners of repute have been deceived for a time by this artifice, but this occurred before the discovery of chloroform or the stethoscope.

Sounds of the fœtal heart.—Another sign is that which is derived from *auscultation.* By the application of the ear or a stethoscope to the abdomen, at or about the fifth month of pregnancy (rarely earlier), the pulsations of the fœtal heart may be recognized and counted. These pulsations are not synchronous with those in the arteries of the mother; they are much more rapid, and thus it is impossible to mistake them. Their frequency, according to Dr. Hope, is in an inverse ratio to the stage of gestation, being 160 at the fifth and 120 at the ninth month. Sometimes, however, the fœtal pulse may descend to 80 or even 60 beats per minute. This sign, when present (like the fœtal movements), not only establishes the fact of pregnancy beyond all dispute, but shows that the child is living. The sound of the fœtal heart is, however, not always perceptible: when the child is dead, of course it will not be met with; but its absence is no proof of the death of the child, because the hearing of the pulsations by an examiner will depend very much upon the position of the child's body, the quantity of liquor amnii, the presence of disease, and other circumstances. Thus the sounds may be distinctly heard at one time, and not at another; they may be absent for a week or fortnight, and then will reappear: so that, although their presence affords the strongest affirmative evidence, their absence furnishes uncertain negative evidence; and several examinations should be made, in the latter case, before an opinion is formed. The earliest time at which the pulsations may be heard has been stated to be about the fourth month, but they will be best heard after the sixth month. The reason why the sounds of the fœtal heart are not always perceived, is owing not only to changes in the position of the child, but to the vibrations having to traverse the liquor amnii and the soft layers of the skin of the abdomen. The presence of much fat in these layers intercepts them. The point where the sounds can be most readily perceived is in the centre of a line drawn from the navel to the anterior inferior spinous process of the ilium on either side—perhaps most commonly on the right. When clearly detected they furnish an unequivocal sign of the pregnant state. Besides the sounds of the fœtal heart, there are other sounds to which the name of 'placental murmur' or *uterine sounds* has been given. These are heard from an earlier date, *i.e.* at any time after the third month. As they may occur in connection with fibroid tumours of the uterus, they do not necessarily indicate pregnancy. (See a paper on this subject by Dr. Druitt, 'Med. Times and Gaz.,' Jan. 21, 1860.)

Kiestein in the urine.—A substance called *Kiestein*, or *Gravidine*, has been found in the urine of pregnant females. It appears as an amorphous iridescent pellicle on the surface of the urine about twenty-four hours after it has been voided. There are various opinions concerning the nature of this substance—some regarding it as a mixture of casein and oil with earthy phosphates (Dr. Bird, 'Guy's Hospital Reports,' April 1840, p. 26), and others as a modification of albumen (L'Héritier, 'Chimie Pathologique,' p. 483). From the researches of Dr. Möller, its presence in the urine is subject to so much uncertainty, that it is wholly unfitted to serve in medical jurisprudence as an indication of pregnancy. (Casper's 'Wochenschrift,' vol. 2, 1845, s. 21.) Dr. Mickschick has arrived at a similar conclusion. ('Med. Gaz.,' vol. 39, p. 264.) Dr. Kane obtained kiestein in equal quantity from the urine of a virgin aged fourteen, and that of a woman who had nursed for two months. (Whitehead, 'On Abortion,' p. 231). Dr. J. Braxton Hicks has shown its existence in a case of imperforate hymen, and in females who had never been pregnant: he has also pointed out the chemical tests for its presence before it forms a pellicle. ('Guy's Hospital Reports,' 1861.) Dr. Golding, however, entertains a high opinion of its value as a sign of pregnancy in its earlier stages, when the other signs are obscure. According to this gentleman, it is present in the urine at all periods of pregnancy, it is identical with milk in a crude form, and is to be regarded as a secretion of the mammary glands. ('Obstetric Record,' vol. 2, p. 45.) Dr. Rees has detected in it milk-globules, and considers it to be caseous matter altered by passing through the kidneys. ('Anal. of Blood and Urine,' p. 217.)

In reference to the above signs it may be observed, that if the motions of the child or sounds of the heart be perceptible, no other evidence of pregnancy need be sought for. The mere suppression of the menses, prominence of the abdomen, and fulness of the breasts, cannot alone establish the fact; but unless the morbid causes of these abnormal states of the system be clearly and satisfactorily obvious to the examiner, it is a fair presumption that the female is probably pregnant. In any case in which a doubt exists we should require sufficient time to form a correct opinion.

Changes in the mouth and neck of the uterus.—The signs hitherto mentioned are chiefly relied on in medical practice; but it must be remembered that no case can possibly occur in civil or criminal jurisprudence in which it will not be in the power of a medical witness to make an examination of the woman. He may then form a safe judgment from the changes which take place in the neck of the uterus, and from the sensation imparted to the finger by the presence of a rounded body (like the fœtus) floating in a liquid, when an impulse is given to the uterus from below. Up to the fifth or sixth month of pregnancy, the neck of the uterus may be commonly felt projecting into the vagina; it is of its usual length, hard and firm. After that period, the uterus rises into the pelvis, and the neck is spread out, shorter and softer, the aperture increasing in size and becoming rounder. Towards the end of gestation, the neck of the uterus appears to be lost, becoming like a thin membrane, and sometimes no aperture can be felt.

Alternate relaxation and contraction of the uterus.—This is a very important symptom, when present. It is seldom that five or ten minutes elapse without its being perceptible to the hand resting on the abdomen. At one time a tumour is plainly defined, more or less firm, and resisting; in a short time this becomes flabby, and sometimes not to be found: again the uterus contracts, and the tumour becomes as apparent as before. This is a condition not to be found in any other than a uterus distended by the results of a conception, if we except a rare case mentioned by Dr. Tanner (see 'Signs and Diseases of Pregnancy,' p. 118). But as similar cases would be attended by hæmorrhage, this would help us to distinguish them from the pregnant uterus. The above phenomenon is constant, and commences at an early date. (See Dr. J. Braxton Hicks' letters to Dr. Hughes Bennett, in 'Lancet,' 1863.) Probably it is to be felt as soon as the uterus is capable of recognition above the brim of the pelvis. It will be noted that the fœtus can be more clearly distinguished during the uterine relaxation.

A well-marked test of pregnancy is the motion perceptible to the finger on giving a sudden impulse to the child through the neck of the uterus. Capuron calls this the touchstone in the distinction of the pregnant state: without it he considers a medical jurist may be easily deceived. To this passive motion of a child, the name of *ballottement* is given. It cannot be easily determined before the fifth or sixth month; but after the latter period, especially as pregnancy becomes advanced, it is always available. In the French schools, the method of applying the *toucher* and *ballottement* to pregnant females is systematically taught, and by a little practice it may be easily acquired. This motion to the child can also be given through the abdomen, by external *ballottement*, in two ways: either by the patient lying on her side, the hand placed on the most depending part of the uterus, or by placing the patient on her elbows and knees: the uterus will then fall forwards, the child also will fall in contact with the front wall of the uterus, and its presence thus be made more perceptible. This latter mode is best adapted for the early stages of pregnancy.

If we find amenorrhœa on suppressed menses, a tumour distended to the size to be expected from the duration of that amenorrhœa—if the tumour be more or less central, alternately relaxing and contracting, containing an irregular-shaped body, which is freely moved within, and also self-moving, we have here indications of a living fœtus: and if we add to these the fœtal heart-sounds, with the other minor symptoms, we have a condition which, if clearly made out, must be considered complete proof of pregnancy. Of course we may have certainty with the fœtal heart-sounds and movements, if well-marked, and a strong suspicion from the other symptoms.

As most of these signs refer to an advanced stage, a witness may be asked, what are the unequivocal indications of pregnancy *before the fifth and sixth month?* The answer to this question is of little moment to a medical jurist, since he is rarely required to give an opinion under these circumstances. In all *legal* cases, when pregnancy is alleged or suspected, it is the practice for a judge or magistrate, on a representation being made by a medical witness, to postpone the decision one, two, or three months, according to the time required for obtaining *certain evidence*. The evidence will consist in plainly distinguishing—1. A rounded body floating freely in a tumour, which alternately relaxes and contracts; 2. The movements of a fœtus; and 3. The sounds of the fœtal heart. The most experienced men agree, that before the *sixth month* the changes in the neck and mouth of the uterus are of themselves too uncertain to enable an examiner to form a safe opinion; and, *à fortiori*, it is impossible to trust to external signs alone. Mr. Whitehead dissents from this view, and considers that a specular examination of the mouth of the uterus is not only more satisfactory than any other mode of exploration, but that it will enable a person to determine with certainty the existence of pregnancy during its earlier stages—from a few days after conception to the middle or end of the fourth month, when auscultation first becomes available. In the *fourth week* the lips of the mouth of the uterus at the centre of their margins are permanently separated to the extent of one or two lines; and the os tincæ (the aperture) itself, which was before a mere chink with parallel boundaries, forms an elliptical or sometimes rounded aperture, which is occupied by a deposit of transparent gelatinous mucus. At *six* or *eight* weeks it is decidedly oval or irregularly circular, with a puckered or indented boundary having a relaxed and lobulated character. The whole circumference of the neck is enlarged, and the commissures or angles of the mouth are obliterated. The mouth continues of this irregular form throughout the whole period of gestation; but from the time of quickening to the end of the seventh month, the progressive changes are not so marked as to form a guide for determining the period of pregnancy. ('On Abortion,' p. 204.) This condition of the mouth of the uterus must not be confounded with its menstrual state in the early stages, nor with a diseased state in the latter stage of gestation.

Feigned pregnancy.—Pregnancy has been sometimes feigned or simulated for the purpose of extorting charity, of obtaining a settlement in a parish, or of compelling marriage; but it is scarcely necessary to observe that an impostor may be easily detected by a well-informed practitioner, since a woman always feigns an advanced stage of pregnancy. Although she may state that she has some of the symptoms depending upon pregnancy (and, unless she has already borne children, she will not be able to sustain a cross-examination even respecting these), yet it is not possible for her to simulate without detection a distension of the abdomen or the state of the breasts. If she submits to an examination, the imposition must be detected: if she refuses, the inference will be that she is an impostor. Females have been known to possess the power of giving apparent prominence to the abdomen, and even of simulating the movements of a child by the aid of the abdominal muscles. By placing them under the influence of chloroform, the abdomen at once collapses, and the imposture is detected. These cases of spurious pregnancy are sometimes met with in hysteric females. (See case by Dr. Simpson, 'Edin. Month. Journ.' 1854, vol. 9, p. 473. See also 'Lancet,' April 14, 1855, p. 381; April 28, 1855, p. 429; and May 26, 1855, p. 533.) Pregnancy may be feigned by a female in order to avoid being sent by a magistrate's order to a distant parish, or to escape the punishment of hard labour, to which she may have been sentenced. If in the latter case the slightest doubt should exist whether the female is really pregnant or not, an affirmative opinion should be given, at least for a time, since great and even irreparable mischief might result by taking an opposite course.

In civil cases of feigned pregnancy, an examination should always be insisted on, or the reputation of a practitioner may suffer by his forming a hasty conclusion on the subject. In this respect the case of *Devonald* v. *Hope* (Q. B., December 1838) is of some interest. A medical man having given an opinion that a female patient was pregnant, subsequently brought an action against her for medical attendance. It turned out, however, that she was not pregnant, and that there were no satisfactory medical grounds upon which his opinion was based. The plaintiff complained of having been deceived by the female as to her condition; but it is obviously in the power of every medical man to prevent such a deception being practised on him. An external examination only will not suffice either to affirm or negative the allegation of pregnancy, except when it is stated to be far advanced. For a singular case in which, on a charge of assault, evidence of this kind was tendered, see 'Med. Gaz.' vol. 36, pp. 1083, 1169. (On the fallacy of the signs of pregnancy, and the simulation of this state, see a paper by M. Tardieu, 'Ann. d'Hyg.' 1845, vol. 2, p. 429; also 1846, vol. 1, p. 83.)

De ventre inspiciendo.—One of the cases in English law, in which pregnancy requires to be verified, is of a civil nature. It is in relation to the Chancery writ '*de ventre inspiciendo.*' A woman may assert that she is pregnant at the time of her husband's death, and the heir-at-law may sue out a writ to require some proof of her alleged pregnancy, as his right to the estate of which the husband died possessed may be materially affected by the result. Until within a recent period the decision of the question of pregnancy was left to twelve matrons and twelve respectable men, according to the strict terms of the ancient writ; but in some late cases it has been considered advisable to depart from this absurd custom, and to place the decision in the hands of skilled medical practitioners or obstetric experts.

In May 1835 a gentleman named *Fox* died, leaving a widow, to whom he had not been married more than six weeks. By his will, made some months before his death, he left the great bulk of his property to the use of Ann

Bakewell, spinster, for the term of her natural life, so long as she remained sole and unmarried; and after her decease or marriage, to one John Marston. Soon after the making of the will this Ann Bakewell became the wife, and subsequently the widow, of Mr. Fox. Notwithstanding that she had married the testator himself, the plaintiff Marston claimed the property of the widow, on the ground of her having infringed the terms of the will by her marriage with the testator! She pleaded pregnancy, and in August 1835 the writ '*de ventre inspiciendo*' was sued out of Chancery by Marston. Some discussion took place in Court on the question whether the writ should be issued in its original indelicate form or not: *i. e.* whether the female should undergo examination by the sheriff, assisted by twelve matrons and twelve respectable men! The widow petitioned the Court not to issue the writ; and put in an affidavit from her ordinary medical attendant, to the effect that she was pregnant, and too weak to undergo the proposed examination. Ultimately it was decided that two matrons, with a medical man on each side, should visit Mrs. Fox once a fortnight until her delivery. There was no doubt of her pregnancy, and she was delivered at the due time, to the great disappointment of the residuary legatee. (See 'Med. Gaz.' vol. 16, p. 697; vol. 17, p. 191.) The nature of this judicial examination will be understood by quoting the terms of the writ addressed to the sheriff: 'In propriâ personâ tuâ accedas ad præfatam R et eam coram præfatis videri et diligenter examinari et tractari facias per ubera et ventrem omnibus modis quibus melius certiorari poteris utrum impregnata sit necne.' (*Register Brevium.*) There can of course be no difficulty in forming an opinion in such a case, provided the pregnancy be at all advanced. It is, however, not a little singular that in the present day any attempt should be made to apply the feudal customs of a rude and barbarous age to the determination of questions which belong exclusively to an advanced state of medical science.

Plea of pregnancy in bar of execution.—The second case in which pregnancy requires to be verified, in English law, is in relation to criminal jurisprudence. When a woman is capitally convicted, she may plead pregnancy in bar of execution. The judge will then direct a jury of twelve married women, '*de circumstantibus*,' to be empannelled, and sworn to try, in the words of the law, 'whether the prisoner be with child of a quick child or not.' If they find her quick with child, she is respited: otherwise the sentence will take effect. In admitting the humanity of the principle by which a pregnant woman is respited until after her delivery, there are two serious objections to the practice of the common law, whereby it is made to fall short of what, in a civilized country, society has a right to expect from it: these are—1st, that the question of pregnancy is allowed to be determined by a jury of ignorant women accidentally present in Court; and 2ndly, that the respite is made to depend, not upon proof of pregnancy, but upon the fact of a woman having quickened! This sign of the pregnant state has been known to occur so early as the third, and so late as the sixth month: some females have even reached the seventh month without observing it: hence, the infliction of capital punishment under these circumstances would be a matter of accident (*ante*, p. 750). Quickening is a sign not easily established, except by extorting a confession from the female; and this is the only possible way in which, in a doubtful case, the question could be determined by a jury of matrons. They commonly trust to feeling externally the movements of a fœtus, but this is at all times a purely accidental circumstance, and they may not be perceptible at the time of the examination. It must be obvious, on the least reflection, that the means resorted to by the English law to determine such a question are bad, and are quite unfitted for the present state of society. Several modern cases show that a jury of matrons may be easily deceived with respect to this sign of pregnancy. In *Rex* v. *Wright* (Norwich Lent Assizes, 1832) the prisoner was found guilty of the murder of her husband by poison. She pleaded pregnancy in bar of execution. The judge empannelled a jury of matrons; and they, after a form of examination had been gone through, brought in a verdict of '*not quick* with child.' The woman would have been executed had not several medical practitioners of Norwich represented to the judge that the method taken to determine pregnancy and quickening was so unsatisfactory that no reliance could be placed upon it. The prisoner was then examined by some medical men, and was found to have passed the usual period of quickening! The judge respited the prisoner, and the correctness of the medical opinion was confirmed by the female being delivered, within four months afterwards, of a healthy full-grown child. (See 'Med. Gaz.' vol. 12, p. 22. In a case tried in March 1838, a woman was convicted of murder, and pleaded pregnancy. A *medical* opinion was here required. The pregnancy, if it existed, had so little advanced that the practitioner was unable to give a satisfactory report: and the judge respited the prisoner for a month, in order that the witness might have full opportunity to ascertain the fact. Still the jury of matrons is occasionally resorted to. Thus in the case of *Reg.* v. *Westwood* (Stafford Winter Assizes, 1843), the matrons were summoned to examine a female capitally convicted, and they negatived the plea! It is not a little remarkable that, although in so many cases the matrons have given a wrong verdict, and that in no instance can they give a right one except as a matter of pure conjecture, this antiquated practice still continues. It was revived at the Central Criminal Court in 1847. (*Reg.* v. *Hunt*, September 1847.) This woman was convicted of murder: she pleaded pregnancy, and the matrons were empannelled and directed to use 'their best skill' to determine whether the prisoner 'was big with a quick child or not.' It was left to their option to have the assistance of a surgeon. In half an hour they returned a verdict 'that she had not a living child within her.' The law was directed to take its course; and the woman would have been executed but for the interference of the Secretary of State. He directed that the prisoner should be examined by competent medical men, who ascertained that she was really pregnant, and had actually passed that stage at which quickening is most commonly perceived. She was therefore respited, and the error in the verdict of the matrons was clearly proved by the birth of a child on the 28th December!

The value of the opinion of a jury of matrons upon such matters, may be estimated from the following facts. The late Dr. Reid records the case of an expert midwife who, when examined in the celebrated Gardner Peerage cause, deposed 'that she had herself once gone ten months with child—that she was always right in her calculations—that she always fainted away at quickening, &c., so that she could never be deceived.' Some time after the trial she applied to Dr. Reid, convinced on such grounds that she was seven months pregnant; but, on examination, Dr. Reid found that there was no pregnancy at all!

There seems to be no uniform rule of practice in such cases. In *Reg.* v. *Featherstone* (Chester Autumn Assizes, 1854), prisoner was convicted of the murder of her child, and a plea of pregnancy was put in by her counsel. A jury of matrons, taken from women present in Court, was empannelled and sworn to try whether she was quick with child, &c. After an examination of the prisoner, the jury, by their forewoman, said:—'The prisoner is not quick with child—she is not in the family-way.' In *Reg.* v. *Weeks* (Exeter Lent Assizes, 1856) this plea was urged in stay of execution on a capital conviction for murder. A jury of matrons was sworn in the usual way to inquire into the fact, and 'two doctors' were sworn to examine the prisoner and give evidence before the jury of matrons. After a short time they found that the prisoner was pregnant, and sentence was respited until after delivery. In *Reg.* v. *Cox* (Durham Winter Assizes, 1862), before Mr. Justice Keating, this venerable institution was again appealed to in aid of the criminal law. A jury of matrons pronounced the female prisoner to be quick with child, and sentence of death was respited. When they find in the affirmative a mistake is of no importance.

It is unnecessary in the present day to discuss the question, whether, until the period of quickening, the child is or is not '*pars viscerum matris.*' The vulgar opinion is, that the fœtus only receives life when the woman quickens; but the law should not base its decisions in reference to capital punishment upon vulgar opinions. As ovum, embryo, or fœtus, the contents of the uterus are as much endowed with special and independent vitality in the earlier as in the later periods of gestation. It is, then, absurd to fix upon an accidental and uncertain symptom, occasionally felt by a pregnant woman, as the point at which clemency may be shown. The bare proof of *pregnancy*, as in the law of France (Art. 27 of the Penal Code), should be sufficient to authorize a suspension of the sentence. The doctrine of quickening has been abandoned in relation to the law of criminal abortion; and there is still greater reason for its immediate abolition in reference to pregnant females capitally convicted.

This change would, however, be attended with but little benefit if the decision of the question of pregnancy were still to remain in the hands of 'matrons.' The record of their mistakes sufficiently establishes the correctness of this view; for if they are unable to recognize the pregnant state at the fifth month, and if, as experts, they are liable to be deceived about their own condition, they cannot fail to be mistaken in their opinions at earlier periods in examining other women. It is, indeed, an extraordinary circumstance, that when married women advanced in pregnancy are themselves continually deceived, and are obliged to consult medical men respecting their condition, they should be specially selected by the law as the persons best qualified to pronounce an opinion upon the pregnancy of a female, in a case involving the infliction of capital punishment. It would be considered inhumane to execute knowingly a pregnant woman, but the imputation of inhumanity is not the less deserved by a custom which virtually leaves the issue in the hands of ignorant and incompetent persons, who may be accidentally present at a criminal trial. The Americans are certainly in advance of us in their legislation on this subject. Thus, by the revised statutes of New York, when pregnancy is pleaded in bar of execution, it is enacted that the sheriff shall summon a jury of *six physicians*, and shall give notice to the district attorney, who shall have power to subpœna witnesses.

These are, I believe, the only two cases in which pregnancy has any direct relation to medical jurisprudence; and it is remarkable that, with respect to them, the law of England has expressly provided that they should be left to the decision of non-medical persons! The following conclusions may therefore be drawn:—1. That the cases in which the signs of pregnancy become a subject of *legal* inquiry in England are rare. 2. That there is no case, in English law, in which a medical man will not have an opportunity of performing an examination *per vaginam*. 3. That a medical opinion is never required by English law-authorities, until the pregnancy is so far advanced as to render its detection *certain*. Hence discussions concerning areolæ, the condition of the breasts, the presence of kiestein in the urine, &c., are, in a practical point of view, unnecessary to a medical jurist. By these remarks I do not intend to undervalue the importance of an accurate knowledge of the signs of pregnancy to a medical practitioner. Cases which may never come before a Court of law will be referred to him, and the serious moral injury which he may inflict on an innocent female by inaccuracy should make him scrupulously cautious in expressing an opinion. The case of *Lady Flora Hastings* furnishes a sad illustration of the effects of such an error. On this subject the reader may profitably consult a paper by Dr. Nelson. ('Lancet,' Nov. 22, 1851, p. 485.) On other occasions his own reputation may suffer by a mistake of this kind. A married lady in Scotland, who had not had a child for a long period, thought that she had become pregnant, and consulted the chief physician in the place, a man of skill and experience (now deceased). He saw this lady several times, and had every opportunity of examining her condition. He gave a decided opinion that she was *not* pregnant. The lady, however, made her preparations, and one night, not long after the medical opinion had been formally given, the physician was sent for to aid in the delivery!

Concealment of pregnancy.—By the law of Scotland, if a woman conceals her pregnancy during the whole period thereof, and if the child of which she was pregnant be found dead, or is amissing, she is guilty of an offence, and is liable to prosecution. Evidence is sometimes given as to outward appearances indicative of pregnancy; but the main proof of a woman having been pregnant, and that which is relied on for conviction, is clear and distinct evidence of the actual delivery of a child. This is generally furnished by medical witnesses. The Scotch law, by making the concealment of pregnancy, under the circumstances above mentioned, an offence, proceeds on the principle that every pregnant female is bound to make preparations for the safe delivery of a child; and it is therefore assumed that if a child be born clandestinely, without preparation, and is found dead or is amissing, its death is owing to the want of such preparation.

Impregnation in a state of unconsciousness.—It was formerly a question whether a woman could become *pregnant* without her knowledge. This may undoubtedly happen, when intercourse has taken place during profound sleep (lethargy, p. 3), or when a female has been thrown into this state by narcotic drugs or vapours. But it is difficult to admit that any woman should remain pregnant up to the time of her delivery, without being conscious of her condition, if the intercourse took place during the waking state. A woman endowed with ordinary intellect could not avoid *suspecting* her condition after the fourth or fifth month: and this alone would be sufficient to induce her to seek advice whereby the fact would become known to her. When a woman is impregnated in a lethargic state, it is unlikely that she should go beyond the sixth month without being fully aware of her pregnancy, as a female with innocent motives would undoubtedly make some communication to her friends. Capuron mentions a case of this kind, in which the fact of pregnancy was first ascertained at the end of the fourth month, by the female having complained to one of her sisters of a strange sensation which she experienced in the lower part of her abdomen. ('Méd. Lég. des Accouchemens,' p. 86.) In a case related by Mr. Skey, a young female who had intercourse knowingly was supposed not to have been aware of her pregnancy until the seventh month; but there is reason to believe that this woman was guilty of deception. ('Med. Gaz.' vol. 39, p. 212.) There are generally, in these cases, strong motives for falsehood; hence such stories require close investigation before they are allowed to influence the opinion of a practitioner. A case occurred in September 1857, in which a woman, æt. 22, described as modest and decorous in her behaviour, then advanced to the sixth month of pregnancy, asserted that she had not consciously had connection with anyone, although she specified a date at which she remembered she had lost her consciousness—

at which date intercourse might have been had! On being questioned, she denied that she had had at any time any soreness or pain in her private parts. Although there may be unconscious intercourse and pregnancy, it is not probable that in the case of a virgin there should be such intercourse without the production of pain, soreness, or laceration; and these symptoms, if not perceived at the time, should be felt subsequently and create a suspicion, if not an actual knowledge, of what had happened. This rendered the account which the woman gave wholly improbable. The fact that she was able to fix a date for her unconsciousness, with an accuracy in accordance with her condition, was also a suspicious circumstance.

Unconscions pregnancy.—It is quite possible that women who are living in connubial intercourse may become pregnant without being conscious of it. Dr. Rüttel mentions the case of a female, æt. 41, who had been married upwards of sixteen years, and who, while returning from a neighbouring village, was suddenly delivered of her first child, when she had only a few days before been complaining that she was not likely to have any children. The child was born living and mature. (Henke, 'Zeitschrift der S. A.' 1844, p. 264.) Mr. Long met with a case in which a married woman, æt. 24, subject to irregular menstruation, consulted him for an attack of spasms. On his arrival, he found that she had suddenly given birth to a seven-months' child. Neither her husband nor herself had the slightest idea that she was pregnant. She had noticed that she had become somewhat stout, and that her breasts were more full than natural. She attributed her condition to improved health, and the cessation of the menstrual discharge was set down to some accidental cause. ('Med. Times and Gazette,' June 13, 1857, p. 592. See also a case at full term by Dr. Tanner, 'Obstet. Trans.' vol. 4, p. 113.) I am indebted to a distinguished judge for the following fact in reference to unconscious pregnancy:—A married lady, who had not had a child for a period of nineteen years, found herself, as she thought, getting unusually stout. She was moving about with her family to different places. At last her size alarmed her, and she thought she was suffering from dropsy: she consulted a physician, who informed her that she was in an advanced state of pregnancy. She treated this opinion with great contempt. In travelling with her daughter, they arrived at a miserable inn: on the night of their arrival, this lady was seized with the pains of labour, and was delivered of a child. She had made no preparation for the birth, and, up to the moment when she was seized with labour-pains, she had not, with all her former experience, the slightest idea that she was pregnant. (For other cases in which married women have had no consciousness of pregnancy, see 'Lancet,' June 16, 1860, p. 609, and June 30, 1860, p. 643.) Instances of this kind are important in reference to alleged unconscious delivery in females charged with infanticide. At the same time, many of the cases in which there are motives for pleading unconscious intercourse or pregnancy require close examination: they will frequently be found to be quite unworthy of belief.

Pregnancy in the dead.—There is no special case in law wherein the *fact of pregnancy* requires to be verified after the *death* of a woman: but an examination may be necessary in order to determine the identity of a body, or to rescue the reputation of a woman from a charge of unchastity. The discovery of an embryo or fœtus with its membranes in the uterus would of course at once solve the question, when the necessity for an examination occurred; and the practitioner will remember that, even supposing many years to have elapsed since interment, and the body to have been reduced to a skeleton, still if the fœtus had reached the period at which ossification takes place, traces of its bones will be found amidst the bones of the woman. In examining the body of a female long after death, for the purpose of determining whether she was or was not pregnant at the time of death, it may be proper to bear in mind that the unimpregnated uterus undergoes decomposition much more slowly than other soft organs. In the case of a female who had been missing for a period of nine months,—whose body was found in the soil of a privy, so decomposed that the bones separated from the soft parts,—the uterus was of a reddish colour, hard when felt, and its substance was firm when cut. The fact was of importance. It was alleged that the deceased was pregnant by a young man, and that in order to conceal her condition he had murdered her. From the state of the uterus, Casper was able to affirm that this organ was in its virgin condition, and that the deceased was not pregnant at the time of her death. On this representation the accused was liberated. ('Ger. Leich. Oeffn.' vol. 1, p. 93.) In examining bodies many months after interment, and in one case upwards of a year, I have been surprised to find, that while other soft organs were decomposed, the uterus had scarcely undergone any change: its substance was still firm and hard.

It may happen that the appearances in the uterus are sufficient to create a strong suspicion that the woman had been pregnant, but the ovum, embryo, or fœtus may have been expelled: in this case several medico-legal questions may arise in reference to delivery.

DELIVERY.

CHAPTER 59.

DELIVERY IN THE LIVING—CONCEALED DELIVERY—ABORTION IN THE EARLY STAGES OF PREGNANCY—THE SIGNS SPEEDILY DISAPPEAR—SIGNS OF RECENT DELIVERY IN ADVANCED PREGNANCY—SIGNS OF DELIVERY AT A REMOTE PERIOD—FEIGNED DELIVERY—DELIVERY IN A STATE OF UNCONSCIOUSNESS—CIRCUMSTANCES UNDER WHICH THIS MAY OCCUR—ADMISSION OF THE PLEA IN CASES OF ALLEGED CHILD-MURDER—SIGNS OF DELIVERY IN THE DEAD—TRUE AND FALSE CORPORA LUTEA—FALLACIES TO WHICH THEY GIVE RISE—CHARACTERS OF THE OVUM OR EMBRYO FROM THE FIRST TO THE SIXTH MONTH.

DELIVERY is a subject which much more frequently requires medico-legal intervention than pregnancy. It will be sufficient to state that the concealment of birth, the crimes of abortion and infanticide, with questions relative to supposititious children, are closely dependent on the proof of parturition. This subject will admit of being considered under two heads:—1. As it relates to delivery in the *living*;—2. As it relates to delivery in the *dead*. In undertaking the investigation, we ought, if possible, to ascertain, either from the female herself or from those around her, whether there was reason to suspect that she had been pregnant. If we can acquire any knowledge on this point it will materially facilitate our inquiry; but this is not always possible. It has generally happened, that previous pregnancy has been so concealed that few who saw the woman suspected her condition: then again, as the admission of her delivery by a living female may be the strongest proof of her criminality, she will perhaps resolutely deny it; and a medical practitioner has no right to extort this admission from her. From this it will be seen that a medical witness must often be prepared to prove the fact of delivery, against the woman who is criminally charged.

Delivery in the living. Concealed delivery.—The signs of delivery in a *living* female vary materially, according to the time at which this event has taken place. In common language, if the contents of the uterus are expelled before the sixth month, the woman is said to miscarry, or to have an abortion: if after the sixth month, she is said to have a premature labour. The law does not admit any such distinction: the expulsion of the ovum, fœtus, or child by criminal violence, at any period of utero-gestation, is regarded as a miscarriage or abortion. It will therefore be proper, in treating this subject, to commence with the earliest period at which the contents of the uterus may be expelled, and to make no artificial distinction between the signs of abortion and delivery. It has been well observed, that the signs of delivery are indistinct in proportion to the immaturity of the ovum. Thus, when it takes place at the second or third month, there are scarcely any proofs which can be derived from an examination of the woman. All the ordinary signs of delivery at the full period will be absent,—the development of the embryo not having been sufficient to cause any prominence in the abdomen, or to give rise to those changes in the system which take place previously to the birth of a mature child: *e.g.* enlargement of the breasts and dilatation of the mouth of the uterus. Abortion at this period (the second or third month) is generally accompanied by loss of blood, which may manifest itself by its effects on the body. This, however, can only give rise to a suspicion. At a later period of gestation there may be a discharge resembling the lochia, and the mouth of the uterus may be found enlarged and soft; but from the small size of the fœtus the outlet will present no positive evidence of delivery. The quantity of blood lost may be greater, and may have a more decided effect on the system. Of course, if the ovum, fœtus, or any of its membranes be found, then the presumption of abortion will be strongly supported: but women who designedly conceal their condition will commonly take effectual means to prevent the examiner from obtaining evidence of this kind.

These remarks relative to the state of the woman apply to an examination made *recently* after abortion. If any delay take place (and this is a common occurrence), even the ambiguous signs which have been mentioned will speedily disappear; so that after a period, which is short in proportion to the earliness of the expulsion, no traces whatever will be discovered. Dr. Montgomery met with a case in which abortion took place, with a considerable loss of blood, at the close of the second month. Twenty-four hours afterwards, the mouth and neck of the uterus were almost completely restored to their natural state. The vagina and external parts were hardly if at all dilated, and very little relaxed; the breasts exhibited imperfectly the appearances which accompany pregnancy, the ordinary sympathetic symptoms of which had been almost entirely absent. ('Cyc. Pr. Med.' 504; Devergie, vol. 1, p. 683.) In such a case as this,—and for such cases a medical jurist must be prepared,—scarcely a presumption could have been entertained of the fact of delivery. After twenty-four or thirty-six hours, in the greater number of cases, we may expect to find, from a personal examination of the woman, no proofs whatever of early abortion.

In order to determine the signs of a 'miscarriage,' as it is termed by our law, at an advanced period of gestation, it will be necessary to describe those which are considered to be characteristic of delivery at the full period. In these cases there will be only a difference in degree: the signs being more numerous and more clearly marked in proportion to the lateness of the period at which the contents of the uterus are expelled. The signs of delivery may be enumerated in the following order:—

Signs of recent delivery in the living.—The female is weak, the countenance pale, the eyes are surrounded by livid areolæ, and there is an appearance of general indisposition. Any severe illness may, however, give rise to similar symptoms. Their sudden occurrence, from a state of previous good health, especially when pregnancy is known or suspected, will create a strong suspicion. The *breasts* are full, especially about the third or fourth day; the nipples are enlarged, and the areolæ around them present all the characters of advanced pregnancy.

1. The *skin* of the abdomen is relaxed, sometimes thrown into folds: the cuticle interrupted by light-coloured broken streaks, passing especially from the groins and pubes towards the navel, which is more or less stretched and altered in appearance. Any disease which has caused enlargement of the abdomen may give rise to a similar appearance in the skin, so that when taken alone much confidence cannot be placed in these lines or streaks as proofs of delivery. The round form of the enlarged and semi-contracted uterus may be felt at the lower part of the abdomen, generally lying towards one or the other side. The apparent size of this organ will depend upon the degree to which it has contracted, and therefore greatly upon the time at which an examination is made. Dr. Montgomery has pointed out the existence of a dark line extending from the pubes to the navel, with a dark areola around the latter, in cases of recent delivery; but he has found this line to exist independently of pregnancy and delivery—in one case in a girl aged 10, and in another instance in a lady labouring under an ovarian tumour.

2. The *organs of generation* will be found externally swollen, contused, or even lacerated, with clots of blood about them. The outlet is much dilated; the mouth of the uterus is considerably open, and its margin completely relaxed. The body of this organ will be found from two to four times the size of the unimpregnated state. It occasionally happens that the neck of the uterus is lacerated on one side during the passage of the head in primiparæ; should this be found, or a cicatrix, it will much assist in proving delivery.

3. *The presence of the lochia.*—This is a discharge, at first of a sero-sanguineous liquid, but which afterwards appears as a brown or green-coloured serum. It commences soon after delivery, and continues from a week to a fortnight, or even longer: it may be absent after the third day. This discharge has so peculiar an *odour* that some have regarded this alone as furnishing strong evidence of recent delivery.

The signs which have been here enumerated are found only when no delay has taken place in making the examination, and the woman has been *recently* delivered. In some strong and vigorous females the body resumes its natural state within a few days, and the traces of parturition may have wholly disappeared or have become so ambiguous as to furnish no satisfactory evidence. In others, again, proofs of delivery will be obtainable for a fortnight or three weeks afterwards. In most cases, however, it is difficult, if not impossible, to say, after the lapse of *eight or ten days*, that delivery has certainly taken place, the signs having commonly by that time disappeared. In all cases the earlier the period at which an examination is made the more satisfactory will be the evidence obtained. Dr. Montgomery once examined a female *five days* after delivery at the full time, and he was particularly struck with the degree to which the parts had become restored to their ordinary condition, especially the mouth and neck of the uterus, which hardly differed from their natural and unimpregnated form. ('Cyc. Pr. Med.' loc. cit.) This inquiry becomes of considerable importance in a case of alleged child-murder. When the body of a child is not found until after two or three weeks from the time of its birth, and the suspected woman denies that she has been delivered of a child, she will probably not deny her pregnancy, but may assert that she has had an abortion at an early period. (See a case by Dr. Walther of Labiau in Casper's 'Vierteljahrschrift,' Oct. 1863, p. 275.) In cases of abortion at an early period the placenta is not always discharged at the time. ('Med. Times and Gaz.' March 12, 1859.) A microscopical examination of the discharges might reveal placental or chorionic structures.

Signs of delivery at a remote period.—A question may arise whether it is in the power of a medical practitioner to determine the period at which delivery took place, *i.e.* how long a time has elapsed. This becomes necessary when, in cases of concealed birth, abortion, or infanticide (some time after suspected parturition), a child is found, and it is required to determine whether the time which has elapsed since the birth of the child, either dead or living, corresponds with the supposed delivery of a suspected female. An opinion may be given within eight or ten days after delivery, from the state of the breasts, of the discharges (lochia), and of the mouth of the uterus; but it becomes difficult after the sixth day: and when the tenth or twelfth day has passed it is still more difficult. After two or three months it may be regarded as impossible to assign the period of delivery with any degree of precision. (See Devergie, 'Méd. Lég.,' vol. 1, p. 446.)

In a case of pretended delivery, contested legitimacy, or disputed chastity (*Frazer* v. *Bagley*, see *post*, DEFLORATION), a medical jurist may be required to say whether a female has, at any antecedent period of her life, been delivered of a child. This question, it must be remarked, can be raised only in respect to delivery at the full period, since there is no doubt that abortion in the early stages of pregnancy may take place, and leave no traces of such an event discoverable in after-life. Indeed, a few days or weeks are sometimes sufficient to obliterate all evidence of the fact. With respect to delivery at the full term, certain signs have been mentioned, which by some are considered indelible. These are: shining streaks on the skin of the abdomen, a brown mark reaching from the navel to the pubes, and the state of the mouth of the uterus, which is said never to close so effectually as in the virgin. In regard to the appearance of the skin of the abdomen, it may be remarked, that any morbid causes giving rise to a distension of the cavity—as ovarian enlargement or dropsy—will produce the same effect: so, also, to a certain extent, extreme emaciation from a state of obesity. (See 'Med. Times and Gaz.' April 17, 1861, p. 450, on False Cicatrices.) Then, again, these marks on the skin are not always persistent throughout life. Besides, a woman, according to the statements of good observers, may be not only once but repeatedly delivered, without having these marks produced. ('Med. Times and Gaz.' June 9, 1860, p. 583.)

With regard to the state of the mouth of the uterus, it is liable to vary in different females, and to be affected by disease—so that a certain judgment cannot always be formed from its condition. In a female who has not borne children the mouth of the uterus is in the form of a slit, the angles being bent down, and giving to it the appearance of the os tincæ (tench's mouth). Mr. Whitehead has observed that, in a woman who has borne children, the mouth becomes elongated, and loses the slight bend at each of its extremities; the labia are thickened, and more nearly of equal size; the commissures are less clearly defined, and the whole of the neck is enlarged, and not so compact in texture. ('On Abortion,' p. 195.) It must be remembered, however, that the condition of the mouth of the uterus, even in the virgin, varies at each menstrual period. Should there be congenital occlusion of the vagina, or the hymen be found imperforate, this will at once negative a previous delivery; but the latter condition will not negative a previous pregnancy, since a woman may have been impregnated, and have had an abortion in the early stage of pregnancy, without a necessary destruction of the hymen. This sort of negative evidence may sometimes be of great value. There is a total want of good affirmative evidence of delivery at a remote period in the living, if we except that which is furnished by the presence of cicatrices in the vagina or of a cicatrix as a result of a lacerated perineum. It is rare, however, that any decision on this subject is required in medical jurisprudence. It might be demanded, either in a case of infanticide, when a woman was accused of having destroyed her alleged offspring some months or years before; or in a case of contested legitimacy, when a female is accused of having substituted a child of which she pretends she has been delivered at some remote period of time.

Feigned delivery.—Delivery has often been feigned by females for the purpose of extorting charity, compelling marriage, or disinheriting parties who have claims to an estate, and in other cases without any assignable motive. Of course, an imposition of this kind could not be sustained before a medical practitioner: and detection is rendered easy, because it is *recent* and not *remote* delivery which is assumed. The latter would, if pretended, be generally cleared up by an examination, as well as by circumstantial evidence. (See case, 'Med. Gaz.' vol. 19, p. 231; also another by Capuron, 'Méd. Lég. des Accouchemens,' p. 110.)

Can a female be delivered unconsciously?—Another important question relative to delivery in a living female is, whether a woman can be delivered without being *conscious* of it. The signs of delivery may be discovered by a practitioner; the offspring may also be found. The female may admit the fact of her delivery, but allege that she was totally unconscious of it. The only medico-legal case in which this plea is occasionally raised is in infanticide; and as the possibility of the occurrence may be questioned, the practitioner must be provided with a knowledge of those facts which medico-legal writers have accumulated respecting it. There is no doubt that a female may be delivered unconsciously during profound sleep, or if labouring under coma, apoplexy, asphyxia, or syncope; or if suffering from the effects of narcotic poisons, the vapours of chloroform and ether, or intoxicating liquors. It is said, also, that delivery has taken place spontaneously while a female was in the act of dying. This, however, has no bearing on the present question. It is in those cases where a female, after her recovery, pleads unconsciousness of delivery that medical practitioners are chiefly consulted. Besides the cases enumerated, hysteria, when accompanied by loss of sense and motion, has been mentioned as a state in which parturition is liable to occur unconsciously. We need not be surprised at delivery taking place under these circumstances, when we consider that the contractile power of the uterus is altogether independent of volition: but, unless the morbid states already mentioned are accompanied by the most profound lethargy and entire loss of sensation, it can rarely happen that the contractions of this organ in its efforts to expel the child, should not at once rouse a woman into consciousness. We ought particularly to expect this in primiparæ, *i.e.* in those who have never borne children. At the same time it must be remembered that parturition in some women, especially when the pelvis is wide and the child small, may take place with such rapidity and ease as scarcely to be accompanied by pain.

It has been observed that, when a woman has frequently borne children, delivery sometimes takes place without effort, and without any consciousness on her part. On other occasions a woman may lie in a kind of torpor or stupor, or suffer from eclampsia (puerperal convulsions), and have no recollection of her delivery. The following case is possible:—A woman may be delivered while under the influence of eclampsia, which might have attacked her before labour set in; and after delivery, but before complete recovery, she might become maniacal—a not unfrequent condition—during which interval she might have killed or injured her child; or the child might have been born dead, or an accidental injury might have occurred to it. She would with truth assert her entire ignorance of it. Her statement would be verified by a bitten tongue, a congested conjunctiva or face. Should albumen be found in the urine this fact would be still more confirmative. Of course eclampsia might occur without these results. The statement might be disproved by finding her actions had shown care and design in other circumstances at the time she said she was unconscious. Mr. King has described the case of a woman, aged 36, the mother of nine children. She received his assistance in her tenth labour: when summoned she was lying calmly and placidly in bed, and was perfectly insensible. He found that the child had been expelled with the placenta. The woman did not recover her sensibility for ten or twelve hours, and then stated that she had no recollection of the birth of the child, or of any circumstances connected with that event: she suffered no pain or uneasiness. Another case is mentioned by this gentleman, in which sensation appeared to be entirely paralyzed during labour. ('Med. Times,' May 15, 1847, p. 234.) It is beyond doubt that profound lethargy occasionally makes its appearance about the time of delivery. Dr. Schulze met with a case in which a female remained in a state of sleep for three days, and was delivered while in this unconscious condition: on awaking, she had no recollection of having suffered any pain during delivery. ('Ann. d'Hyg.' 1845, vol. 1, p. 216; 'Med. Gaz.' vol. 36, p. 40.) Dr. Montgomery relates the case of a lady, the mother of several children, who, on one occasion, was unconsciously delivered during sleep. ('Cyc. Pr. Med.'; see also case in 'Brit. and For. Med. Rev.' No. 9, p. 256.) Dr. Palfrey describes a case in which labour commenced and progressed in a woman to the second stage during sleep. ('Lancet,' 1864, vol. 1, p. 36.)

The results obtained by the use of the vapours of chloroform and ether show that the expulsive efforts of the uterus are often as energetic in the unconscious as in the conscious state. It may appear extraordinary, however, that a primiparous woman, unless rendered unconscious by narcotic substances, should be delivered without suffering pain: nevertheless, a case of this kind is recorded by Dr. Wharrie. The woman's age was 21; she had been in labour about six hours; she complained of no pain, and the child was born without effort or consciousness. The child was healthy but small, weighing rather more than four pounds. ('Cormack's Journal,' January 1846, p. 12.) Notwithstanding this case, it is in the highest degree improbable that any primiparous female should be delivered during *ordinary sleep* without being roused and brought to a sense of her condition.

There is another condition in which a woman may state that her delivery took place unconsciously; and this, from its being one of the most common species of defence set up by a female charged with child-murder, must here claim our attention. Thus she will allege that, while suffering from pain, she felt a strong desire to relieve her bowels: that she went to the water-closet for that purpose, and was there delivered without knowing anything of the occurrence until it was too late to save the child. This kind of desire is a very common symptom of the parturient state; and in private practice it is often difficult to restrain a woman from yielding to the feeling, when it certainly would be attended with hazard to the child. ('Med. Times and Gaz.' April 4, 1857, p. 347.) We must therefore admit that an accident of this kind can occur; although here, as in every other instance in which unconscious delivery is pleaded, a medical witness ought to inform himself, or be informed, of all the particulars which are stated to have attended delivery, before he gives an answer applicable to the case. As a general rule, it cannot be denied that delivery may take place under these circumstances, and a woman not be conscious of it; but before we make this admission in regard to any particular instance, we ought to have a statement of all the facts from the female herself. It is thus that we shall avoid the risk of seeing a premature medical opinion set aside by the subsequent production of circumstantial evidence. Besides, it has been properly observed that, *after* an accident of this kind, a woman cannot be ignorant of her having been delivered. Females who have raised this plea in cases of child-murder have often been known to maintain that they were unconscious of their pregnancy, and thus have attempted to excuse themselves for not having prepared the articles necessary for childbirth. It is possible that a female, especially one who is pregnant for the first time, may not be aware of her pregnancy in the earlier stage; but it is rare for one to advance to the full term without being conscious of it. Women who have borne children have not unfrequently consulted medical men; and although nearly at full term they have been unconscious of their state. In the majority of instances, it may be presumed that a woman thus situated must have had some reason to *suspect* her condition; and if only a suspicion existed in the mind of one who did not contemplate the destruction of her offspring, there would assuredly be many circumstances forthcoming which would at once establish her innocence. If this remark applies to married women, it applies with still greater force to those who are unmarried, since the fact of illicit connection, and the fear of its consequences, must render them peculiarly alive to all those changes which, by common repute, take place in the female system during pregnancy.

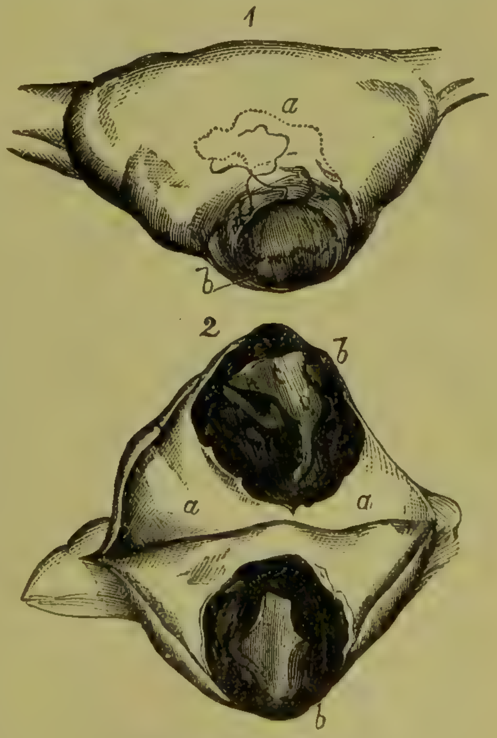
Signs of delivery in the dead.—It will now be proper to examine the signs of delivery which are derivable from an examination of the body of a woman after death. Occasionally we may obtain some history of the case during life, by which our labour will be much facilitated; but, on the other hand, every fact may be studiously concealed from us, and then we may be required to prove not only the delivery but the previous pregnancy. These investigations relative to pregnancy and delivery in the dead body are almost exclusively confined to cases of criminal abortion, where the contents of the uterus have been expelled at the sacrifice of the life of the woman. Death commonly ensues in these cases within two or three days after delivery, and then satisfactory proofs are obtainable by a post-mortem examination; but if the female has survived three or four weeks, it will be as difficult to determine delivery in the dead as in the living subject. This remark applies to delivery at the full period; for if the uterus have expelled its contents in the first months of pregnancy, the traces of this expulsion will have generally disappeared in the course of a few days.

The following may be taken as the chief appearances when the body of a woman is examined soon after delivery at the *full* period. The uterus is like a large flattened pouch from nine to twelve inches long, its mouth being wide open. The cavity contains coagula of blood or a sanguineous fluid; and its surface is covered with the remains of a decidua—the outtermost membrane of the embryo or fœtus. In the part to which the placenta has been attached, the substance of the organ appears exposed, presenting several large semilunar or valvular openings. This portion of the uterus is of a very dark colour, so as to have given rise to a suspicion that the organ was gangrenous. The vessels are extremely large and numerous. The Fallopian tubes, round ligaments, and ovaria are so vascular (full of blood) that they have a purple colour. The spot whence the ovum has escaped is more congested than the rest of the ovarian surface. Obstetric writers differ greatly in their statements respecting the size of the uterus at different periods after parturition; and these differences may be explained, partly by the fact that the uterus contracts more rapidly in some women than in others, and partly, perhaps, by the circumstance of the birth having been, in some instances, premature. Dr. Montgomery states that, after delivery at the full period, and under perfect contraction of the uterus, if the body be examined within a day or two, it will be found seven inches long and four broad. Its substance, on making a section, will be from an inch to an inch and a half in thickness, and will present the orifices of a great number of large vessels. At the end of a week the uterus is between five and six inches, and at the end of a fortnight about five inches in length: the density of its structure has during this period increased, but its substance has considerably diminished. The inner surface is still bloody, and covered partially with a pulpy membrane resembling the decidua. The orbicular direction of the fibres around the internal orifices of the Fallopian tubes is at this time very distinct. In about a month the uterus will have become fully contracted; but the mouth rarely, if ever, closes so completely as in the virgin state. In a case examined by Dr. Barnes, in which a primiparous female, aged 26, died from puerperal fever on the *sixth day* after delivery, the following appearances were met with in the uterus. The internal surface was blackened and congested, especially in those parts to which the placenta had been attached. There was the appearance of suppurative action in this part. The substance of the uterus was healthy: there was no pus in the sinuses. The os uteri showed considerable ecchymosis. The vagina was healthy: the iliac veins contained nothing but loosely coagulated blood. There was in the left ovary a small well-marked corpus luteum, having a central cavity. ('Med. Gaz.' vol. 41, p. 294.) This condition of the uterus must not be confounded with the appearances which are observed when death takes place during *menstruation.* Dr. Judee found in the bodies of three females who died during menstruation that the uterus was somewhat enlarged—its walls being thickened and its interior lined by a reddish gelatinous layer about 1-12th of an inch thick consisting of a capillary network of vessels, enclosed in a mucous-like membrane. When this was removed the uterus below was found to be white and firm. The interior of the neck was of a greyish colour: the lips were swollen, of a dull-red, bluish, or even black colour. On compressing this part small drops of blood issued. This was not observed either in the neck or body of the vagina. A section of the uterus presented only the normal fibrous tissue: but at the level of the mouth (os uteri) there was a mass of tissue resembling a portion of apoplectic lung. The blood during menstruation, according to this gentleman, issues entirely from the highly congested mouth of the uterus. ('Gaz. des Hôpitaux,' No. 39, and 'Med. Times and Gaz.' June 23, 1855.) An ecchymosed condition of the neck of the uterus is very commonly found as the result of even an easy labour, and therefore forms a good guide where present. This point must be borne in mind in reference to criminal abortion, inasmuch as the neck has the appearance as if violence had been employed.

From the statement of appearances given above, it will be seen that there must be considerable difficulty in determining the period prior to death at which delivery took place. The difficulty is increased when a female has been prematurely delivered, or when death has not taken place until some time after delivery. A medical opinion may be then in some degree strengthened by searching for those signs which have been described as characteristic of delivery in the living. These, if present, will always furnish strong corroborative evidence, not only of the fact of delivery, but of the period at which it had probably occurred.

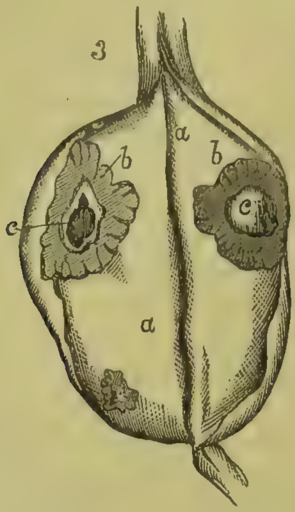
Evidence afforded by the presence of corpora lutea.—The condition of the *ovaries* has been considered to furnish strong evidence, in the dead body, not so much of delivery as of previous pregnancy. These organs, as it has been already stated, when examined soon after delivery, are found of a deep purple colour, owing to their extreme vascularity. If the woman has really been pregnant, we may expect to find, on one of the ovaries, the appearance which is denominated a *corpus luteum.* (See Fig. 1.) The accounts given by obstetric writers of the characters of corpora lutea, and the evidence which they are capable of furnishing in legal medicine, are very conflicting. According to Dr. Montgomery, in a *true* corpus luteum (*i.e.* of pregnancy) the ovary presents a protuberance with a distinct cicatrix on the part whence the ovum has escaped. The protuberant portion will be found on section to have an oval form and to be of a dull yellow colour—hence the name *corpus luteum.* It is full of blood, and in texture resembles the section of a kidney. In the centre of this section there may be either a *cavity* or a radiated white *cicatrix* (scar), according to the period at which an examination is made. The cavity remains for about three or four months after conception, and is surrounded by a strong white cyst: as gestation advances the opposite sides approximate, and a radiated white cicatrix results. The size and vascularity of the corpus luteum are considerably diminished by the time gestation is completed, and in about five or six months afterwards—*i.e.* fourteen months after its first formation—it disappears altogether from the ovary; so that the corpus luteum of one conception is not found with that of another, unless a premature expulsion of the contents of the uterus has taken place. ('Cyc. Pr. Med. Pregnancy,' p. 496; see also 'Edinburgh Monthly Journal,' Jan. 1845, p. 58.) The presence of a corpus luteum, as it is here described, does not prove that a woman has borne a child. In the opinion of some obstetric authorities, it establishes that conception has taken place; but the embryo may have been converted into a mole or a blighted fœtus, and expelled at an early period. It was formerly supposed that *one* true corpus luteum only was met with in pregnancy with one child; but among other facts which show that such an inference is erroneous, is a singular case reported by Dr. Renaud to the Manchester Pathological Society. He examined the body of a female who died in the seventh month of her pregnancy, and from whose uterus he extracted a fœtus. There were no traces of a blighted ovum. The ovary, however, presented *two* distinct and well-marked corpora lutea. ('Med. Gaz.,' vol. 39, p. 599.) Had the ovary alone been examined, it might have been supposed that this female had had twins.

The corpus luteum is of its greatest size in the early stage of pregnancy, and gradually diminishes as gestation advances. From the third month to the full term it has a dingy yellow colour on section. The annexed illustrations are taken from cases which occurred to Dr. Paterson, and have been published by him in the 'Edinburgh Medical and Surgical Journal' (vol. 53, p. 49). Fig. 1 shows the external appearance of the ovary in the case of a woman who died a *few days* after impregnation: *a* represents the body of the ovary; *b* the corpus luteum, as it appears on the exterior. Fig. 2 represents the same ovary, in which a section has been made through the corpus luteum.

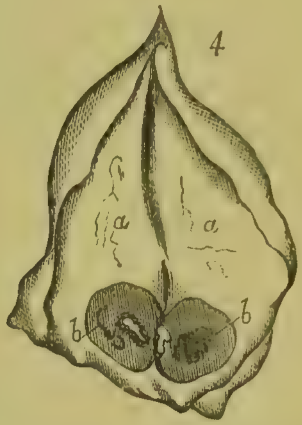


Ovary with corpus luteum.

In Fig. 3 a section of an ovary is represented showing the appearance of a corpus luteum in a woman who died in the *second month* of gestation: *a a*, the body of the ovary; *b b*, the plicated or folded structure of the corpus luteum; *c*, the central cavity, frequently containing blood. This cavity does not always exist.



Section of ovary with corpus luteum, second month.



Section of ovary with corpus luteum at the full term.

Fig. 4 represents a section of the ovary of a woman who died thirteen days after delivery at *the full period*: *a a*, body of the ovary; *b b*, the corpus luteum seen in section, with a central cavity. It was of a yellowish colour in the shaded portion. These engravings represent the ovary and corpora lutea of their natural size.

According to Dr. Paterson, the *false* corpora lutea, or those which are produced irrespective of pregnancy, are to be distinguished from the *true* by the following signs. The false bodies have in general an irregular form, and want either a central cavity lined with a distinct membrane, or a *puckered cicatrix*: they have no concentric radii, and are frequently numerous on both ovaries. Dr. Ramsbotham agrees with Drs. Montgomery and Paterson in considering that the true corpus luteum—*i.e.*, that derived from conception—is known either by its having a *central cavity*, sometimes unoccupied, at others filled with the blood which was effused at the time that the coats gave way, or, if it should be of more ancient date, by its presenting stelliform *radiated white lines* (a puckered cicatrix), resulting from the closing of this cavity. ('Obstetric Medicine,' p. 49.) Dr. Paterson relates the following case, in order to show that the presence or absence of a *true* corpus luteum may be sometimes important in a question of disputed identity in the dead. Four medical students were charged with having disinterred the body of a lady; but the body was so disfigured that the deceased could not be identified by her relatives. In one of the ovaries a *true* corpus luteum was reported to have been found; a discovery which, if true, proved that it could not be the body of that lady, since she was a virgin, and advanced in life. On the trial the medical evidence was very conflicting; one half of the witnesses maintained that the body which was found in the ovary was a true corpus luteum, while the others contended that it was not!—so that the question was left undetermined.

In opposition to these views Dr. Knox, an experienced anatomist, asserts that there is no distinctive character whereby what is called the *true* can be distinguished from the *false* corpus luteum, the only difference being that the latter is smaller. What have been called corpora lutea may be formed in virgin animals, independently of intercourse; and the time of their disappearance from the ovary varies from three months to an almost indefinite period. ('Med. Gaz.' Dec. 22, 1843.) That there is considerable difficulty in distinguishing true from false corpora lutea, is proved by reference to a case reported in the 'Medical Gazette' (vol. 34, p. 623) in which two experienced observers differed. Dr. Lee thought that a preparation which was the subject of examination was not a corpus luteum, while Mr. Wharton Jones thought that it was,—founding his decision on a microscopical examination. This difference of opinion shows that a distinction is by no means so simple a matter as some writers assert. Mr. W. Jones agrees with Dr. Knox in considering that a corpus luteum may occur in the ovaries independently of intercourse, and that the existence of one in this organ would therefore afford no proof whatever of intercourse having taken place. The discovery of the *ovum* in the uterus, *in process of development*, could alone, in the present state of our knowledge, warrant an affirmative opinion on this point in a court of law; and this I believe to be the safest view of this much-contested question. On the other hand, the absence of a corpus luteum from the ovary would not in all cases warrant an opinion that conception had not taken place.

The researches of Professor Bischoff ('Med. Gaz.' vol. 35, p. 443, *et seq.*) have shown that the production of a corpus luteum is by no means necessarily connected with *conception*. The ova undergo a periodical maturation, about the time of menstruation, and escape from the ovary or are extruded whether there be conception or not; hence fecundation is more likely to occur when intercourse is had about this period. This is also the opinion of Raciborski; indeed, some physiologists now regard menstruation as the alternative of conception (see 'Dub. Quart. Jour.' May 1846, p. 426), and consider that there is no period so favourable to conception as that which immediately follows the cessation of the menses. In this respect the Koran appears to conflict with the laws of physiology, since it is laid down by Mahomet that women are impure for eight days before and eight days after menstruation. (Rostan, 'Cours d'Hyg.' t. 2, p. 438.) The same custom, according to Meigs, exists among the Jews as to the period at which a woman is clean after the cessation. ('Obstetrics,' p. 128.) It is not a little singular that this comprises the period at which, according to modern theories, conception most readily takes place. Women may conceive during the flow of the menses: it is also well ascertained that a woman who has never menstruated may conceive, and that conception may take place one or two days *before* the period of menstruation. Raciborski has met with several instances in illustration of these views. ('Advances in Physiology,' Baly and Kirkes, p. 59.)

In this theory we have an explanation why corpora lutea, or bodies closely esembling them, are so often found in virgin animals, and it would also ccount for those differences of opinion, among experienced men, which almost nvariably occur when it becomes a debated question whether a corpus luteum s true or false. The theory would further explain cases like the following, reported by Mr. Elkington:—A woman, aged 42, who had not borne child for *seven years*, died from diseased lungs. On the right ovary were wo corpora lutea, and the Fallopian tube on that side was larger and more ongested than on the other. The deceased expected to menstruate on the day he died, or at least one day later. ('Prov. Med. Jour.' Feb. 1845, p. 104.) r. Ritchie, of Glasgow, has by his results confirmed the views of Professor ischoff and Mr. W. Jones. He calls these bodies 'corpora menstrualia vel riodica.' They may, in his opinion, be formed independently of pregnancy, nd may possibly assume all the characters of what are called corpora lutea, y some reflex excitement in the uterine organs. According to this gentleman ere are no fewer than eight varieties, which are liable to have their aracters intermixed. ('Med. Gaz.' vol. 36, pp. 985, 1058.) A case in which a well-marked corpus luteum was found coinciding with menstruation in a female who had been executed, is reported by Dr. Michel. ('Med. Gaz.' vol. 44, p. 307.) Such an appearance might create a difficulty in the case of a woman who had aborted in the second or third month of pregnancy, and in whose uterus no remains of a decidual membrane were found. A man was accused of drowning a girl, who was pregnant. One ovary contained a corpus luteum of considerable size, more marked than the ordinary false corpus luteum, but it had not arrived at its full development. Signs of abortion were traceable in the uterus, but not of very recent date.

A full account of the general and microscopical characters of true and false corpora lutea, by Dr. Renaud, will be found in the 'Edinburgh Monthly Journal,' August 1845, p. 589. (See also 'Recent Advances in Physiology,' by Drs. Baly and Kirkes, 1848, p. 46.) These gentlemen conclude, from their researches, that cases can seldom occur in which the mere presence of a corpus luteum can be taken as a proof of previous impregnation; and they consider the following rules to be deducible from the facts which they have collected:—1. A corpus luteum in its early stage (that is, a large vesicle filled with coagulated blood, having a ruptured orifice, and a thin layer of yellow matter within its walls) affords no proof of impregnation having taken place. 2. From the presence of a corpus luteum, the opening of which is closed, and the cavity reduced or obliterated (only a stellate cicatrix remaining), no conclusion as to pregnancy having existed can be drawn, if the *corpus luteum be of small size*, and does not contain so much yellow substance as would form a mass the size of a small pea. 3. A similar corpus luteum of larger size than a common pea, would furnish strong *presumptive* evidence, not only of impregnation having taken place, but of pregnancy having existed during several weeks at least; and the evidence would approximate more and more to complete proof, in proportion as the size of the corpus luteum was greater. (Op. cit. p. 57.)

From this statement, it will be perceived that the difference is only relative and arbitrary, chiefly depending on the *size*: and as in pregnancy corpora lutea are found of variable size, while in menstruation they may, under great excitement, attain a large size, it is obvious that no safe inference can be drawn from their presence, irrespective of other signs of impregnation. The terms *true* and *false*, therefore, are inappropriate; and serious mistakes may arise by a reception of evidence on this point. The law requires absolute certainty, not merely probability or presumption; and, in the present stage of physiology, the proof falls short of that which is necessary to guide the verdict of a jury. At a trial for attempted abortion, *Reg.* v. *Goodall* (Notts Lent Assizes, 1846), on examining the body of the woman on whom the attempt had been made, it was alleged that she was *not* pregnant: but on inspecting the ovary, a corpus luteum was there discovered. This was described as *false*, apparently because there was no other proof of impregnation. Had an embryo or its membranes been found in the uterus, or had there been some proof of their expulsion, it would probably have been described as *true*. Dr. Meigs, an experienced writer, says that corpora lutea may vary in size, but in all cases they are real. Physiologically speaking, they do not admit of a division into true and false. ('Females and their Diseases,' 1848, p. 43; see 'Ed. Mon. Jour.' Oct. 1851, p. 305.)

From these considerations, therefore, it appears to me that the only conclusion to which we can come is, that medical evidence respecting the nature of a corpus luteum in an unknown case, if received by a Court of law at all, should be received with the greatest caution, and only from a witness of great experience. The old doctrine on this subject, that the presence of such a body on the ovary affords *certain* and undeniable evidence of impregnation, may be regarded as completely subverted.

Characters of the ovum or embryo to the sixth month.—Hitherto the examination has been confined to the woman, but it is now necessary to describe the characters of the ovum or embryo, and its enveloping membranes at the early stages of pregnancy, since, when this can be procured, it may furnish good medical evidence. If the ovum be expelled within a *month* after conception, it is scarcely possible to detect it, owing to its small size, and its being enveloped in coagula of blood. Burns examined three uteri, within the first month, where no expulsion had taken place, but even under these favourable circumstances he failed in discovering the ovum. At first the ovum contains no visible embryo, but it appears merely to consist of vesicular membranous coverings. According to this authority, when first distinctly seen through its membranes, it is of an oblong form and about a line (the twelfth of an inch) in length. At the *sixth week* it is slightly curved, resembling, as it floats, a split pea. In the *seventh week*, it is equal in size to a small bee; and by the end of the *second month* it is bent, and as long as a kidney-bean.

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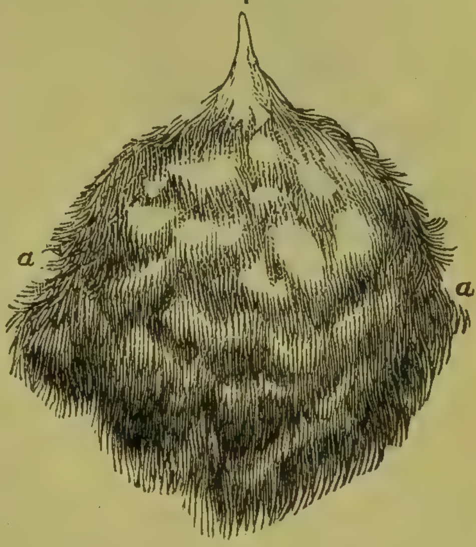

The Ovum at one month.

Fig. 1 represents the appearance of the ovum at the end of the *first month.* All that is seen here is the loose shaggy surface of the chorion or second membrane (*a a*). The embryo itself is not seen, as this is enclosed within an inner membrane, called the amnion, which contains a fluid in which the embryo is immersed.

Fig. 2 represents the embryo (*b*) at *six weeks*, surrounded by its membranous coverings, and, on the outside, the chorion (*a*).

Fig. 3 shows a more advanced stage of the ovum, namely, at about *two months* after impregnation. The embryo (*b*) is assuming a fœtal form—the head being downwards, and the place for the eye already indicated: *a a*, the chorion; *c*, a portion of the decidua or external membrane.

These engravings are taken from actual specimens in the Museum Collection of Guy's Hospital. They appear much larger than the description above given would lead a reader to suppose, but this is owing to the original specimens being suspended in spirit. By this they acquire an artificial bulk, owing to the flocculent surface of the chorion spreading out to its fullest extent. When removed from the liquid medium, they collapse into a much smaller bulk, and it is thus that they are liable to be carried away and lost in a discharge of blood. If the embryo cannot be found, some portions of the membranes—especially of the decidua or uterine membrane—may be detected in the uterus.

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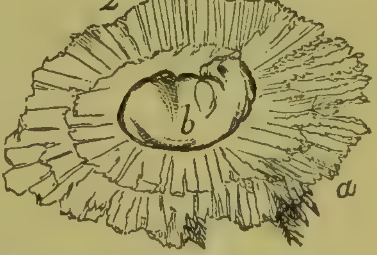
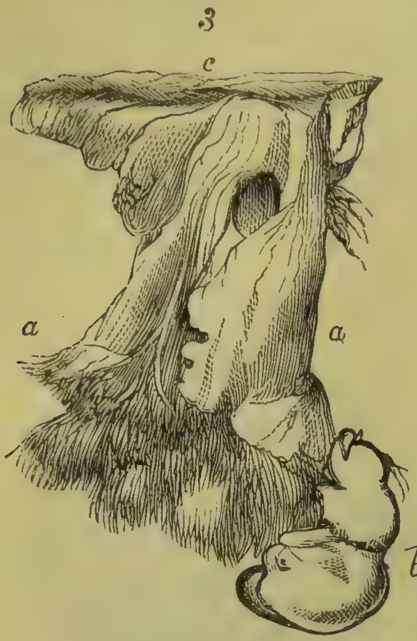


The Embryo in its Membranes at six weeks.

In reference to the terms here employed, the 'ovum' signifies the embryo and its membranous coverings; the 'embryo' is the body which is afterwards converted into the fœtus; 'fœtus' is applied to the embryo after the third or fourth month of gestation.

After the second month development goes on rapidly: the features are in part well-marked, and the limbs are gradually formed. At the *third month*, the fœtus weighs from one to two ounces: when stretched out it measures about three inches, and the genital organs, although the sex is not then distinguishable, are large in proportion to the rest of the body. The membranes are larger than a a goose's egg. At the *fourth month* the fœtus is from five to six inches long, and weighs from two to three ounces; at the *fifth month* it measures from six to seven inches, and weighs from five to seven ounces; and at the *sixth month*, its length is from eight to ten inches, and its weight about a pound. (For the characters of the child beyond this period, see 'Infanticide.') The great difficulty will consist in determining the nature of the supposed ovum or embryo between the second and third month. In making the examination, it should be placed in water, and all coagula gently washed away from the membranous coverings or removed by some blunt instrument. Alcohol may be used as a substitute for water, after the blood has been removed. If the embryo cannot be found, the decidua and chorion or portions of them may be recognized:—the former by its forming the outer investment with its smooth internal and rough external or uterine surface; the latter, by the villous or shaggy appearance of that portion of it which would have become the placenta. Between the third and fourth month the fœtus may be commonly identified without much difficulty. The ovum in many instances escapes first, leaving the decidua behind. This comes away after a time, but it is important to remember that, in some states of the virgin, decidua-like structures are shed from the uterine mucous membrane, which, when examined by the microscope, are in essence like the true decidua. Both are constituted of the innermost portion of the uterine mucous membrane, and contain all its elements.



Embryo and Membranes at the second month.

Moles.—The true mole is the result of conception, the fœtus of which has died in consequence of the effusion of blood into the decidua and the various membranes, and, should a placenta exist, into its structure. The sac of the amnion has frequently burst, and the ovum has escaped, or it has died and been dissolved by the liquor amnii or serous liquid, which is found turbid. The remains of the umbilical cord are frequently found on the interior of the amnial sac. Nodules are found projecting into the cavity, which are produced by the effusion of blood outside the sac. Sometimes the cavity is almost obliterated, the main bulk being made up by effused blood. In the varieties of moles it is not difficult to recognize all the membranes; the microscope will always enable the examiner to detect the chorion villi. Such a mole of course proves conception, but solid bodies are expelled from the uterus which have not this origin, and may occur in the virgin: these are called false moles. A clot of blood may become dense, and, losing some of the colouring-matter, exhibit appearances which cannot be distinguished from the true mole except by the microscope. Polypi may also resemble a mole; but a careful examination would readily show the absence of ovular membranous structures. Sometimes a large exfoliation of the vaginal epithelium may take place, and before its expulsion, become condensed so as to cause suspicion. The microscope will, however, show that it consists of only tesselated epithelium. Moles may coexist with true pregnancy in a case of twins. The symptoms accompanying a mole resemble those of pregnancy: and the appearances produced by its expulsion are not to be distinguished from those attending the abortion of a fœtus at an early period of gestation. The only means of distinction would be derived from an examination of the expelled matters. The local injury produced by the expulsion of these bodies on the organs of generation is by no means so great as that caused by delivery at the full period.

Vesicular mole (*Hydatiniform degeneration of the chorion*).—When by some accident the fœtus dies at any time before the complete formation of the placenta, the villi of the chorion, instead of completely dying, retain a certain amount of vital force; the consequence of which is that in some parts growth goes on imperfectly, serous fluid is effused within, and the part is distended into a globular form. This, occurring frequently in the course of each villus, gives it a beaded appearance, and the whole mass appears something like a bunch of grapes. The size, however, of each vesicular body varies much in different specimens, and also in different portions of the same specimen, some being only detectable by the microscope, while others are as large as the largest grape. On the large kinds are generally to be found small villi, undergoing more or less the same process of change.

Thus it will be observed that the vesicular growths are attached one to another by delicate threads, the unchanged stem of the villus. This will readily serve to distinguish them from true *hydatids* (Dr. Graily Hewitt, 'Obstetric Transactions,' vol. 1, p. 249), concerning the distinction between which much confusion has existed, and questions have arisen as to whether the vesicular mole can exist in the virgin. From what has just been shown it will be perceived that this latter cannot arise except as a result of impregnation. It is exceedingly rare to find *true* hydatids in the uterus at all, still more so for them to be discharged through the cavity of the uterus. Dr. Hicks informs me that no authentic account of such a case is on record. But even if it were not so, the slightest examination by the unaided eye would show whether the vesicles were attached to each other as above mentioned, or the smaller are enclosed within the larger cysts, or floating without any attachment whatever. The use of the term 'hydatid' does much to perpetuate the error. How long this vesicular mole may remain in utero is uncertain; accurate information is required on this point. Certainly it may remain more than a year, and possibly many years. The rapidity with which they grow is very great, but is readily explained by the fact that it is a simultaneous enlargement of myriads of parts. A woman at the third month of pregnancy may be as large as at the seventh month; she may ultimately attain a size exceeding that of the full term.

Cases of twin-conception are not uncommon, in which one ovum becomes vesicular, the other going on towards maturity. (Dr. Hall Davis, 'Obstetric Transactions,' vol. 3, p. 177.) Again, one ovum may become vesicular, while the other is converted into a fleshy mole. In some rare cases a portion only of the chorion is changed into this form of mole, while the proper formation of the placenta may go on in the normal manner.

The question here arises—Can the mature placenta be so converted? Should a portion be left behind in a healthy state, can it assume the vesicular degeneration? From all that is at present known, this is exceedingly improbable; from observations made of late years, it appears that the change only takes place in the *chorion* villi before the formation of a placenta. It is much more probable that, should a woman have no intercourse after a labour, but yet expel a true vesicular mole, that it was a twin ovum which was not expelled during labour. In the early state of pregnancy a decidual covering will always be found more or less complete around this mole, but if the size of the mass be great, then, although present, it will be less observable, being spread over a larger surface. A *corpus luteum* will also be found, but not so perfectly formed as in normal pregnancy.

The ordinary symptoms of pregnancy accompany this state, although in all forms of mole-pregnancy it is imperfectly marked, or only proceeds to a certain point. (See case, 'Obstetric Record,' vol. 1, p. 21.) It is also to be remembered that the effects of the expulsion of a mole are very similar to those of abortion. These facts may have an important bearing on medico-legal practice, and in this respect the following case, reported by Dr. Chowne to the Westminster Medical Society, November 1843, will be found of interest:—A woman was seized with the pains resembling those of labour, and a mass of uterine hydatids was expelled, which was supposed to have been in the uterus about five months. When the woman was examined, thirty-six hours afterwards, there were all the signs of recent delivery about her. The parts of generation presented the usual appearances met with in the expulsion of a fœtus: the breasts were enlarged, the areolæ elevated, of a brown colour, the follicles prominent, and the organs evidently containing milk. The occurrence of this case led Dr. Chowne to think that, had the body of an infant been found with marks of violence upon it, concealed in the house where this woman lived, it would probably have been pronounced to have been her child. A medical man might have strengthened the suspicion of criminality by declaring that there were all the signs of recent delivery about her. It may be observed, however, that in such a case the woman would probably have stated that no child, but some tumour, had come away from her; and a medical man would not be justified in swearing that appearances of delivery absolutely indicated, under all circumstances, that a woman must have been delivered of a *child*. On the contrary, it is a well-known medical fact, that similar appearances may arise from the expulsion of the various forms of mole. (See a case of Mr. Pearson's, 'Medical Times,' Dec. 30, 1848.) Circumstantial evidence would be against her only on the assumption that some person had wilfully concealed or made away with the substantial proofs of her innocence—*i.e.* the mass which had been expelled. Some of the questions which have been here considered were raised on the trial of *Angus* for the murder of *Miss Burns*, at the Lancaster Assizes, 1808. It was alleged that the deceased was pregnant—that the prisoner had administered corrosive sublimate to her to procure abortion, and that this had caused her death. A question arose at the trial relative to the appearances of the uterus as indicative of recent delivery. On examining this organ, it was found considerably enlarged, and on its inner surface was a mark four inches in diameter, plainly discernible, to which the placenta had been apparently attached. The mouth of the uterus was much dilated. Indeed, the appearances were described to be such as might have been expected to be found two hours after birth of a full-grown fœtus. The evidence respecting previous pregnancy was conflicting; and the prisoner was acquitted, because the death of the deceased could not be distinctly traced to any criminal act on his part. The ovaries were not examined until after the trial, when a body considered to be a true *corpus luteum* was found in one of them; and some eminent authorities agreed that it indicated an advanced stage of pregnancy. (See Paris and Fonblanque, 'Med. Jur.' vol. 2, p. 179.) One medical witness appeared for the prisoner; and he contended that the state of the uterus did not justify the medical inference that there had been recent delivery. He assumed that the appearances might have been due to the expulsion of a group of 'hydatids.' If by the term 'hydatids' he intended the vesicular ovum, he admitted the fact of a conception, and therefore the motive would remain the same. If he intended the true hydatids, then their cyst would have been observable in the uterine wall, and the point of its bursting into the uterine cavity plainly distinguishable; for it is clear that true hydatids would not grow in the uterine cavity itself. The medical defence was for that date ingenious, but at the present time would, for the above reasons, be inadmissible. The contents of the uterus were not produced—a fact which left the case in mystery.

CONCEALMENT OF BIRTH.

CHAPTER 60.

CONCEALMENT OF THE BIRTH OF A CHILD—DEFINITION OF THE OFFENCE—FEMALES ACQUITTED OF INFANTICIDE FOUND GUILTY OF CONCEALMENT—MEDICAL EVIDENCE FROM THE REMAINS OF THE BODY—ANALYSIS OF BONES—THE CHILD MUST BE DEAD—CONCEALMENT OF THE OVUM OR EMBRYO—NOT NECESSARY TO PROVE WHEN THE CHILD DIED.

Concealment of birth.—Medical evidence respecting delivery is required in two cases: 1st, when the birth of a child is wilfully concealed; and 2ndly, when the contents of the uterus have been prematurely expelled by criminal means. The concealment of pregnancy is no offence in the English law; but the concealment of *delivery* or of *the birth* of a child is a misdemeanor by the 24 and 25 Vict. c. 100, sec. 60, the words of which are to the following effect:—'If any woman shall be delivered of a child, *every person* who shall by *any secret disposition* of the dead body of the said child, whether such child died before, at, or after its birth, endeavour to conceal the birth thereof, shall be guilty of a misdemeanor, and being convicted thereof shall be liable at the discretion of the Court to be imprisoned for any term not exceeding two years, with or without hard labour.' A proviso is added to the effect that any person tried for the murder of any child, and acquitted thereof, may be found guilty of concealment of birth, if it shall appear in evidence that the child had recently been born, and that such person did by some secret disposition of the dead body endeavour to conceal the birth.

Various interpretations have been put upon the terms 'concealment' or 'secret disposition' of the body. This part of the evidence does not affect a medical witness, unless he himself has found the dead body or was present when it was found. It will rest with the judge to determine whether the body has been so disposed of as to constitute legally a misdemeanor. (*Reg.* v. *Clarke*, Chelmsford Summer Assizes, 1864.)

This is an offence of which those women who are charged with child-murder are commonly convicted in England: while the Scotch law punishes females for the concealment of pregnancy if the child be dead or amissing. (Alison's 'Criminal Law,' p. 153.) The medical evidence on trials for this misdemeanour is exclusively derived from an examination of the mother; and thus, much will depend upon the time at which this is made. With respect to the child, its body need not even be produced, provided there be satisfactory evidence of its death: the body may have been secretly buried or burnt, and in the latter case it may be necessary to examine the ashes. (See p. 114.)

According to the statute the child must be *dead*—the concealment of the birth of a living child not being any offence, unless it should happen to die before its birth was made known. In the case of the *Queen* v. *Woodman* (Kingston Lent Ass. 1845), the woman was acquitted because the child was living when concealed. Mr. Chitty says, that in order to constitute the offence, the child must have advanced to the end of the seventh month ('Med. Jur.' p. 412); but it is to be presumed that the concealment of the birth of a dead child at the sixth or under the seventh month would be as much an infringement of the statute as if it were more advanced. The concealment of the aborted but undeveloped ovum or embryo—of a monster, *i.e.* a child without human shape, a mole or other morbid growth—would not probably be considered a contravention of the statute. I am not aware that there has been any judicial decision on this point. Mr. Lane communicated to the 'Medical Times' (Aug. 1845) a case in which a charge of concealed birth was dismissed by the magistrates of Surrey, because the concealment referred to a child born at the eighth month *in its membranes.* The woman stated that she did not consider it to be a child! If this decision be correct, the main object of the statute (*i.e.* to prevent secret delivery, so often leading to murder) may be effectually evaded. The case, being entirely new, should have been sent for trial, and the decision left to the proper interpreters of the law; a magisterial decision can furnish no precedent on a question of this kind. This woman must have been delivered of a child, fœtus, or embryo, or of course there would have been no pretence for the charge. A singular case of alleged concealment of birth occurred at the Suffolk Lent Assizes, 1853. A married woman was charged with having concealed the birth of her infant child. It appeared that her husband and the neighbours supposed she was pregnant. After the child was reported to have been born, it was alleged that it had died, and preparations were accordingly made for the burial. The coffin was examined, and was found to contain not the body of a child but the figure of a doll. The learned judge directed the grand jury that before they could find a bill, charging the prisoner with the guilt of concealment, they must be satisfied (but of this there was no evidence on the depositions) that the woman had really been delivered of a *child.* The prisoner had been a married woman for a number of years, and her conduct could only be accounted for on the supposition that she had endeavoured to impose upon her husband and her neighbours. The case fell to the ground.

It will be perceived that it is not material here, as it is in a case of alleged infanticide, to prove *when* the child died—whether before, during, or after its birth; and thus those subtleties and technicalities which are met with in cases of child-murder are avoided. In regard to proof of concealment, and what constitutes it, these are essentially legal points; but a medical practitioner may sometimes benefit an accused person, if he can prove that the female had made application to him on the subject of her pregnancy and delivery. The law is especially lenient under such circumstances. Questions connected with concealment of birth do not fall under the jurisdiction of a coroner:—the medical evidence is therefore required by a magistrate. Medical witnesses were formerly exposed to much trouble and inconvenience in giving their evidence on these occasions (see 'Med. Gaz.,' vol. 19, p. 287); but the defect has been remedied by a recent statute. (1 Vic. c. 44.)

In a case under the Scotch statute in reference to the concealment of pregnancy, for a report of which I am indebted to an eminent legal authority, this question arose, viz.—'Whether the charge was excluded if the woman, an unmarried female, proved that she had intimated that she was with child to the father, but denied the pregnancy to everyone else? That the object of the statute was defeated in such a case, and yet that the main fact on which the statutory offence is founded was proved, could not be doubted. Concealment, and not calling and making use of assistance in the birth, constitute the offence. The Court of Judiciary was nearly equally divided. The majority went on the bare terms of the statute: the minority held that concealment was here a general term to denote the denial to all near and around the woman, and from whom assistance might be obtained, and was coupled with not calling for assistance in the birth. As a letter written to Australia, if the father had gone there, could not be taken to exclude the statutory offence, and as the woman concealed her pregnancy and had obtained no assistance in the birth, an expression which shows what the character of the concealment referred to is, the communication of the fact of pregnancy to the father of an illegitimate child (often more anxious to get rid of the child than the mother) really could not lead to its preservation, and left the concealment which the statute referred to, equally complete. But the point was not actually decided, as it was thought that the terms of the special verdict did not raise the question, but, by an accidental form of expression, excluded it.'

CRIMINAL ABORTION.

CHAPTER 61.

ABORTION FROM NATURAL CAUSES—ITS FREQUENCY. CRIMINAL CAUSES—LOCAL VIOLENCE—ABORTION BY MECHANICAL MEANS—MEDICINAL SUBSTANCES—POPULAR ABORTIVES—SIGNS OF ABORTION—SPECIFIC ABORTIVES—LOCAL APPLICATIONS. FEIGNED ABORTION—MEANING OF THE WORD NOXIOUS AS APPLIED TO DRUGS—ON INDUCING PREMATURE LABOUR—PROOF OF PREGNANCY NOT NECESSARY—ABORTION OF MONSTERS—EXTRA-UTERINE CONCEPTIONS—ABORTION OF MOLES AND HYDATIDS.

By abortion is commonly understood, in medicine, the expulsion of the contents of the uterus *before the sixth month of gestation.* If the expulsion take place between the sixth and ninth month, the woman is said to have a premature labour. The law makes no distinction of this kind, but the term abortion is applied to the expulsion of the fœtus at *any period of pregnancy* before the term of gestation is completed; and in this sense it is synonymous with the popular term *miscarriage.* Criminal abortion is rarely attempted before the third month:—it is perhaps most common between the fourth and fifth month: because then a female begins for the first time to acquire a certainty of her pregnancy. The causes of abortion may be either *natural* or *violent.* The latter only fall under the cognizance of the law:—but a medical witness should be well acquainted with the causes which are called natural, in contradistinction to others which depend on the application of violence. These *natural* causes are so frequent, that—according to Mr. Whitehead's observation,—of 2,000 pregnancies, one in seven terminated in abortion. These causes are commonly ascribable to peculiarities in the female system,—to the presence of uterine or other diseases, or to some moral shock sustained by a woman during pregnancy. Any diseases which strongly affect the uterus or general system of the female may give rise to abortion. An attack of smallpox has been known to produce it; and it has been suggested by Mr. Acton, that the presence of constitutional syphilis in the father is not only a cause of infection in the offspring, but of repeated abortion in the female. ('Med. Gaz.' vol. 36, p. 164; Ramsbotham's 'Obstetric Medicine,' p. 655.) These facts deserve attention, when it is proved that a woman has really aborted, and an attempt is unjustly made to fix an alleged act of criminality on another. For further information on the numerous natural and accidental causes which may give rise to abortion, the reader may consult the work of Mr. Whitehead ('On Abortion and Sterility,' p. 252; also, for the effects of undue lactation and diseases of the placenta, in causing abortion, see 'Med. Times and Gaz.,' Dec. 4, 1852, p. 580, and March 19, 1853, p. 302.) In considering the operation of these causes, it is proper to bear in mind that during pregnancy the uterus is subject to a natural periodical excitement, corresponding to what would have been the menstrual periods dating from the last cessation. Hence comparatively trivial causes operating at these periods may lead to an expulsion of the fœtus.

The *violent* causes of abortion may be of an accidental or criminal nature. In general, the distinction will not be difficult: the kind of violence, and the adequacy of the alleged cause to produce abortion, will be apparent from the evidence. In reference to criminal cases, the causes may be referred either, 1st, to the use of *mechanical* means, or 2ndly, of irritating *medicinal* substances acting upon the uterus or bowels. They operate with greater certainty just in proportion as the pregnancy is advanced.

Mechanical means.—Among the mechanical causes may be mentioned—severe exercise, the violent agitation of the body, as by riding or driving over a rough pavement, in which case no marks of violence would be apparent. Any physical shock, sustained by the body, may operate indirectly on the uterus. Blows or violent pressure on the abdomen are sometimes resorted to; but in these cases the marks of violence will be commonly perceptible. Instruments have been devised for the purpose of piercing the membranes, destroying the child, and thereby leading to its expulsion. Devergie speaks of such instruments being well known in England, and of English midwives deriving a living from the practice of this crime (Op. cit. Vol. 1, p. 285.) Although this must be regarded as an exaggerated statement, it cannot be denied that cases have transpired which show that the crime is frequently perpetrated by persons who basely derive a profit from the practice: and for one case that comes to light probably a dozen are effectually concealed. In the evidence given on four trials, within a recent period, the cases presented no feature of novelty or interest. Instruments were employed, and drugs in large doses were proved to have been administered.

Mechanical means are undoubtedly more effectual in producing abortion than medicinal substances; yet, from the fact of such attempts being made by ignorant persons, the woman generally dies from inflammation of the womb or peritoneum, or other serious after-consequences. A case was tried some years since, in which the evidence showed that the prisoner had attempted to produce abortion in the deceased by thrusting wooden skewers into the substance of the uterus. Inflammation and gangrene took place, and the woman died. The prisoner was convicted, and executed for murder. (For a similar case by Mr. M'Pherson, see 'Med. Gaz.' vol. 36, p. 102; see also another case in the same journal, vol. 45, p. 693.) This kind of injury to the uterus always implies the interference of some other person in the perpetration of the crime. Mechanical means can seldom be applied to the uterus without leaving marks of violence on this organ, as well as on the body of the child. If the mother should die, a result which generally takes place, an inspection will at once settle the point. ('Ann. d'Hyg.' 1834, 191; 1838, vol. 1, p. 425; 1839, vol. 2, p. 109.) An important case of this kind was the subject of a criminal trial in Scotland in 1858 (case of *Reid*, 'Medical Gazette,' December 11, 1858). The uterus near its mouth presented two openings in its substance, described as punctured wounds by the medical witnesses for the prosecution who made the examination,—and as the openings of torn bloodvessels by others who were called for the defence. There was also a rupture of one ovary. The prisoner was convicted; but the medical man who was supposed to have been the principal agent in the crime committed suicide. The case is chiefly important in showing that any apparent mechanical injury to the uterus should be minutely examined, so that no doubt of the cause may afterwards be entertained. If, in a case of this kind, the mother survive and the child be expelled, then marks of violence will be found on its body. These marks may not be sufficient to account for its death; but that is not here the question. If it can be proved that they have not resulted from accidental causes during gestation or subsequently to delivery, then their presence may furnish strong corroborative evidence of the actual means by which abortion was attempted. It is said that abortion has been in some instances accomplished by frequent bleeding from the arm. This effect may follow as a result of shock produced by the loss of a large quantity of blood. An examination of the veins of the arms would show whether any such attempt had been made.

There can be no doubt that of all the exciting causes of abortion, the most effectual, and that which most certainly brings on the expulsive action of the uterus, is the destruction of the ovum or embryo. If by accident or design the ovular membranes should become ruptured, gestation is arrested, and abortion necessarily ensues. At any period of pregnancy, therefore, a puncture through the membranes will sooner or later occasion the evacuation of the uterus. (Ramsbotham's 'Obstetric Medicine,' p. 655.) This author remarks that the performance of the operation demands a most accurate knowledge of the anatomy of the ovum and the maternal structures, as well as of the state of development which the neck of the uterus assumes at different periods of pregnancy. In medical practice for the induction of premature labour, the membranes are ruptured either by the use of a female catheter, or by an instrument of this shape, but including a blade like a tonsil-lancet. Unless the inner membrane or amnion be opened, gestation may still proceed, and abortion will not take place. When the membranes are completely penetrated and the waters are discharged, uterine action is invariably induced, but the time which elapses from the performance of the operation to the commencement of labour is subject to great variation. Dr. Ramsbotham states that he has known the uterus begin to act in *ten hours* after the rupture, but in another case a week elapsed before its action commenced. As a general rule, uterine action is fully established in fifty or sixty hours. It must not be supposed, however, that where a criminal intention exists, so long a period is required for removing the contents of the uterus. The cases above referred to were cases of obstetric practice, in which there was no desire to expose the female to the slightest risk, and premature labour was openly induced. In a criminal attempt by a medical practitioner, in which the woman would be a consenting party to the act, the removal of the embryo or fœtus might be effected in a much shorter period of time. At any rate, the time for the completion of abortion could not be measured by cases in which the uterus has been left to undergo spontaneous contraction after the membranes had been punctured, and the waters had escaped. There would, however, be great danger to a female in the necessary manipulations required. The reader will find reports, by M. Tardieu, of numerous cases of abortion as a result of mechanical means applied to the uterus, in the 'Annales d'Hygiéne,' 1855, vol. 1, p. 406; and some good practical remarks by the same writer, on the mode in which these inquiries should be conducted, in the 'Annales d'Hygiéne,' 1856, vol. 1, p. 141.

It is obvious that this mode of perpetrating abortion is only likely to succeed in the hands of persons who have a complete anatomical knowledge of the parts. The certain death of the woman will convert the crime to murder, when instruments are introduced into her body by persons who are ignorant of anatomy. It is to be regretted that members of the medical profession have on several occasions misused their professional knowledge, and have exposed themselves to prosecutions for this crime. Sometimes it is probable the charge has been raised falsely, or through misapprehension on the part of the woman; at others, the evidence has left it very clear that the charge was well-founded. Of late years medical men have rather freely used the speculum. When this instrument has been improperly or unnecessarily used on a pregnant woman, a charge of attempted abortion by instruments may be easily raised against a medical practitioner. A trial took place at the Exeter Lent Assizes, 1854 (*Reg.* v. *Griffin and Venn*), in which it was charged that the accused, Venn (a surgeon), had feloniously used an instrument with the intent to procure the miscarriage of the prosecutrix. According to the evidence, Venn had on several occasions passed a round polished instrument into the body of the woman, once in a coppice and at another time in a field. The defence was, that the surgeon had merely used a speculum to ascertain whether the girl was pregnant, in order to know how to prescribe for her; and that it was absurd to suppose that he had ever intended to procure abortion, for this had not followed, and it might have been easily produced by him at any period of pregnancy if prisoner had wished it. The prisoners were acquitted. Admitting the statements of the prosecutrix and prisoner to be correct, it may be remarked that medical practitioners, in the lawful exercise of their profession, do not commonly use a speculum in open fields or coppices to determine whether a female is pregnant or not: and it is a well-known fact that a speculum is not required for determining the question of pregnancy at all. This case conveys a serious caution to members of the medical profession.

Medicinal substances.—These are, perhaps, more frequently resorted to for inducing criminal abortion than other means; but they rarely answer the intended purpose, and when this result is obtained, it is generally at the expense of the life of the woman. Mineral poisons have been ignorantly employed for this nefarious object,—such as arsenic, corrosive sublimate, sulphate of copper, muriate of iron (*Reg.* v. *Wright*, Abingdon Autumn Assizes, 1855), and other irritants. Croton-oil, gamboge, colocynth, aloes (Henke, 'Zeitschrift,' 1844, vol. 2, p. 203), hiera picra, a mixture of aloes and canella (p. 263), elaterium, and other drastic purgatives, have also been used for a similar purpose. Purgatives which produce much straining, and powerful emetics or diuretics, will readily excite abortion in the advanced stages of pregnancy; but these violent medicines fail in their effect at the earlier stages. A decoction of fern or of broom-tops has been sometimes used. The decoction of broom acts as a strong diuretic. In the case of *Reg.* v. *Morris* (Reading Lent Assizes, 1858), a decoction of fern was used. It merely produced sickness. The substances just mentioned exert an indirect action on the uterus by producing a shock to the general system: but there is a certain class of bodies, called emmenagogues, which have a specific action on the uterus itself. Among these, the ergot of rye, or secale cornutum, may be particularly noticed. Other vegetable, animal, and mineral substances, which may be enumerated as having acquired popular repute for procuring abortion, are savin, cantharides (see p. 271), rue, iron-filings, squills, grains of paradise (*Reg.* v. *Rushforth*, York Autumn Assizes, 1857), pennyroyal, black hellebore, and tansy. M. Tardieu relates three cases in which a strong decoction of rue produced abortion at the fourth, fifth, and beyond the sixth month respectively, and the women recovered. ('Ann. d'Hyg.' 1855, vol. 1, p. 403.) Its operation as an abortive was generally preceded by well-marked nervous symptoms—*e.g.* giddiness and stupor, depression of the action of the heart, with nausea and severe pain in the stomach. ('Ann. d'Hyg.,' 1856, vol. 1, p. 135.) In April 1856, a medical man was convicted before the Central Criminal Court of Sydney, of administering extract of belladonna in a suppository, with a view to procure abortion. In a case which occurred in France iodide of potassium was pronounced by three medical men to be an abortive

('Med. Times and Gazette,' Jan. 29, 1859), but the grounds for this opinion are not given. None of these substances have any influence on the uterus, except in affecting it indirectly by their irritant action on the system. In the Coroners' return for 1837-8, there were four cases of the administration of savin and other drugs, with the view of procuring abortion. In three of these cases, the mother died undelivered; in the fourth, the child perished.

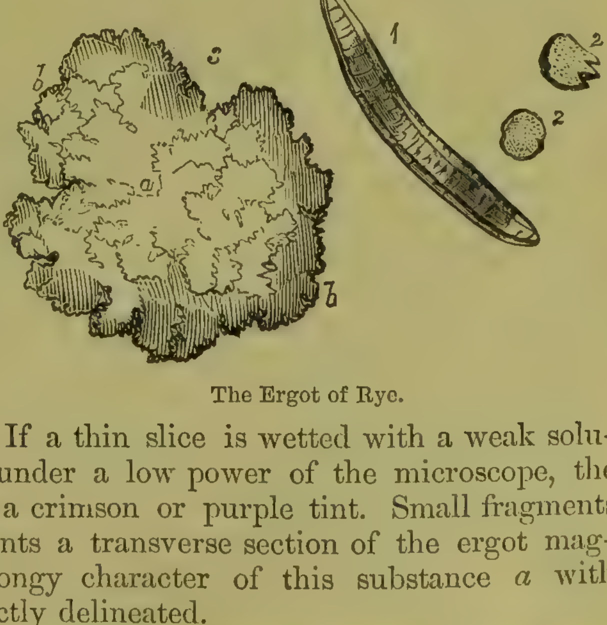
Specific abortives. Ergot of rye, or secale cornutum.—This substance has been found, in many instances, to bring on violent action of the uterus at an advanced stage of gestation, or when efforts at parturition had already commenced. There is, however, considerable difference of opinion respecting its alleged specific properties. According to Dr. Lee, it has no effect, at least in the *early* stages of gestation, although given in very large doses. ('Med. Gaz.,' vol. 25, p. 10; see also 'Edin. Med. and Surg. Jour.,' vol. 53, p. 27.) Dr. Kluge, of Berlin, found that its properties varied according to whether it was gathered before or after harvest; in the former case it had an energetic action, while in the latter it was powerless. The properties of the secale are but little known to the vulgar in this country; and this may account for the fact of our rarely hearing of cases in which it has been criminally administered by midwives to pregnant females. Dr. Beatty states that when used in obstetric practice it is liable, by absorption into the system of the mother, which may take place within two hours, to endanger the life of the child. ('Dub. Med. Jour.,' May 1844, p. 202.) This question was actually referred by the French Government to the Academy of Medicine in 1845, as there was reason to think that, under its employment in the practice of midwifery, children were frequently born dead. ('Ann. d'Hyg.,' 1846, vol. 1, p. 204; see also 'Med. Gaz.,' vol. 46, p. 680.) In confirmation of Dr. Beatty's statement, Drs. M'Clintock and Hardy report, that, out of thirty cases in which it was administered, twenty children were born dead. ('Practical Observations,' p. 95.) Dr. Ramsbotham considers that the drug may operate fatally on a child according to the circumstances under which it is administered; but that, unless it excites the expulsive action of the uterus, it has no effect on the child's system. (Op. cit. p. 319; also cases by Mr. Paterson, 'Edin. Med. and Surg. Jour.,' vol. 53, p. 142.) According to M. Millet, in commenced or imminent abortion, ergot procures a safe and prompt termination; and he never met with a case in which it injured the child. ('Med. Chir. Rev.,' July 1855, p. 41.)

On trials for criminal abortion, perpetrated or attempted, a medical witness must be prepared for a close examination on the specific emmenagogue properties of the ergot of rye on the uterus, as well as its general action as a poison on the woman and child. A case, which occurred a few years since (*Reg.* v. *Calder*, Exeter Lent Assizes, 1844), has been reported, with comments on this subject, by Dr. Shapter ('Prov. Med. Jour.,' April 10, 1844). It was alleged on this occasion, that savin, cantharides, and ergot had been respectively given by the prisoner, a medical man, for the purpose of procuring miscarriage. The prosecutrix was a woman of notoriously bad character, and the prisoner was acquitted. There were three medical witnesses, who agreed that savin and cantharides were only likely to occasion abortion indirectly, *i.e.* by powerfully affecting the system—the view commonly entertained by professional men. Some difference of opinion existed with regard to *ergot*. Dr. Shapter stated, in his evidence, that he did not think the ergot would act unless the natural action of the uterus had already commenced—a statement supported by a number of authorities. Subsequently to the trial, he collected the observations of many obstetric writers, and so far modified his opinion as to admit that the ergot might *occasionally* exert a specific action on the uterus, in cases of advanced pregnancy, even when uterine action had *not* already commenced.

His summary on this subject is one of the best which has been published. Dr. Ramsbotham has reported three cases from which it would appear that the ergot may in some instances exert a direct action on the impregnated and quiescent uterus. In these instances, the females were in or about the *eighth* month of pregnancy. ('Med. Gaz.,' vol. 14, p. 434.) This observation has been fully confirmed by further experience on the use of the drug. ('Med. Times and Gaz.,' Jan. 7, 1854, p. 8; see also his 'Obstetric Med. and Surg.,' p. 198.) Dr. J. H. Davis believes that it is a specific excitant of uterine action, and points out the cases in which, in his opinion, it may be safely employed. ('Lancet,' Oct. 11, 1845, p. 393.) In a case in which, owing to distortion of the pelvis, it was necessary to bring on labour six weeks before the full period, Mr. Raynes found that ergot in the form of infusion in repeated doses exited the action of the uterus, and delivery was accomplished within fifty-eight hours of the taking of the first dose. The uterus was in a quiescent state before the medicine was given to the patient. ('Med. Times and Gaz.,' March 14, 1857, p. 260.) Mr. Whitehead, who has had considerable experience on this subject, has found that its action is very uncertain. In a case under his care, that of a woman with deformed pelvis, it was considered advisable to procure abortion in the fifth month of pregnancy; the ergot alone was employed, and at first with the desired effect. It was given in three successive pregnancies; and in each instance labour-pains came on after eight or ten doses had been administered, and expulsion was effected by the end of the third day. It was perseveringly tried in a fourth pregnancy in the same female, and failed completely. ('On Abortion,' p. 254.) It also failed in a case in the hands of Dr. Oldham. ('Med. Gaz.,' vol. 44, p. 49.) Nevertheless, the balance of evidence is decidedly in favour of its specific action, as a direct uterine excitant; and, according to Dr. Griffiths, this is so well known to the inhabitants of the United States, that it is there in frequent use as a popular abortive. Perhaps the differences which have been observed in its action may have depended on the quality of the drug, as well as on the period at which it was administered. Admitting that the uterus is subject to periodical excitement, corresponding to the menstrual periods, it is probable that the action of ergot may be more powerfully abortive at these than at other times. In a case in which I was consulted in 1860, an attempt had been made to administer secretly the ethereal tincture of ergot.

A case occurred at Brighton, in October 1864, in which a question arose respecting the fatal effects of this drug on a woman who had taken it for a long period, obviously with a view to procure abortion. She died, however, without abortion having taken place; and the question at issue was, whether this drug had or had not caused her death. The dose taken was, I am informed, about a teaspoonful of the tincture of ergot three times a day, for a period of eleven weeks. On inspection, patches of inflammation were found on the mucous membrane of the stomach after death. No other cause for death was apparent, and one medical witness assigned it to the poisonous irritant action of the ergot, as, at the early stage of pregnancy which she had reached (the third month), this substance would not be likely to act as an abortive. Another medical gentleman who gave evidence at the inquest, asserted that death could never be primarily caused by ergot of rye. The qualification introduced into this medical opinion is of small importance. The deceased woman is reported to have taken a large quantity of the tincture, and it is immaterial whether the drug killed her by a primary or secondary operation. M. Tardieu describes the case of a woman, æt. 24, who aborted in the fourth month of pregnancy, as a result of the administration of ergot in powder; she died from peritonitis in about twenty-four hours. The ergot was found in fragments in the lower third of the bowels. ('Ann. d'Hyg.,' 1855, vol. 1, p. 404.) At the same time this medical jurist states that, in his opinion, ergot of rye has no direct action as an abortive. ('Ann. d'Hyg.,' 1865, vol. 1, p. 139.) In respect to its operation, it may be observed that the effects produced by its administration are not such as readily to excite suspicion. It does not cause the decided symptoms of irritation observed in the action of savin, nor the nervous symptoms which are usually produced by rue. In medicinal doses, given at proper intervals, the only marked effect which it produces on a pregnant woman is a lowering of the pulse. Sometimes other symptoms of a severe character have presented themselves. ('Ann. d'Hyg.,' 1856, vol. 1, p. 140.) If a person dies from the effects of the drug, the results are legally the same whether its operation as a noxious substance is of a primary or secondary kind.

Action of ergot.—In doses of from half a drachm to two drachms ergot in powder has caused nausea, vomiting, dryness of the throat, great thirst, aversion to food, pain in the abdomen, slight purging, pain in the head, stupor, and dilatation of the pupils. (Pereira, 'Mat. Med.' vol. 2, pt. 1, p. 111.) Paralysis is said to have been observed among the symptoms. (See paper by Mr. Wright, 'Edin. Med. and Surg. Jour.,' vol. 53, p. 14.) The medicinal dose of the powder in uterine diseases is from 5 to 15 grains. It is employed in a larger dose (from 20 to 60 grains at intervals of half an hour) to excite uterine action either for abortion or parturition. The dose of the tincture is one drachm (a teaspoonful); this is considered to be equivalent to 20 grains. The dose of the ethereal tincture, according to Pereira, when employed for the purpose of exciting uterine action, is one drachm every half-hour for three or four doses. (Op. cit. p. 119.) Ergot must be regarded as a noxious substance, and by some authorities it is ranked among narcotico-irritant poisons. It does not easily cause death in one large dose, but its fatal operation appears to be more strikingly developed by its long-continued use in small or medicinal doses. Its active properties are considered to be due to the presence of an oil which is soluble in ether. It also contains a solid principle, *ergotin*, which exerts a poisonous action on animals. The reader will find a large collection of cases, illustrating the properties of this drug, in Wibmer ('Arzneimittel und Gifte,' vol. 2, p. 80—*Sphacelia segetum*; see also Pereira, 'Mat. Med.' vol. 2, pt. 1, p. 102).



The Ergot of Rye.

Analysis.—The form and characters of the ergot in mass are well known to professional men. In the annexed illustrations, 1 represents the ergot of rye of its usual form and size. The outer coat is dark-coloured, almost black, and it is more or less grooved or fluted longitudinally, and pointed at each end. It is brittle, and breaks with a spongy or soft rough fracture. 2 2 represent transverse sections of the ergot of rye. The outer coat here forms a dark outline with depressions. The substance is of a pale reddish-white colour. If a thin slice is wetted with a weak solution of potash, and is examined under a low power of the microscope, the outer dark coat gradually assumes a crimson or purple tint. Small fragments may be thus identified. 3 represents a transverse section of the ergot magnified thirty diameters. The spongy character of this substance *a* with its dark coat *b*, is here more distinctly delineated.

When the powder of ergot is rubbed with a solution of potash it evolves a fishy odour, and the solution acquires a dingy-red colour. In the form of tincture, alcoholic or ethereal, one test is the peculiar odour of the extract when treated with potash. This may, however, be concealed by other odours. Sometimes small particles of ergot, presenting a pink-red colour and a dark external coat, may be detected in the sediment by the microscope. When ergot has been taken in powder, fragments of it may be found scattered over the lining-membrane of the stomach or bowels; these may be identified by the characters described. The ethereal tincture evaporated to an extract leaves an oily-looking residue, which, when treated with a solution of potash, acquires a light or pinkish-red colour.

Savin. Oil of savin.—This vegetable substance possesses great popular repute as an abortive. In a case which I was required to investigate in 1845, it was a question whether savin, which had been taken in the state of powdered leaves, and had caused the death of a woman, exerted any specific action on the uterus to induce labour. The reply was given, that in large doses it acted only indirectly as an abortive by its irritant properties. (See 'Med. Gaz.,' vol. 36, p. 646.) It is proper to remember that the infusion is more powerful than the decoction; since the poison, being a volatile oil, is dissipated by long boiling. Savin is, however, commonly taken or administered in the form of powdered leaves. The irritant action of this powder has been elsewhere considered (p. 264); the method of detecting the powder in the contents of the stomach is there described. Any portion of the leaves dried and rubbed will emit the peculiar odour of savin, by which it may be identified.

In a case tried at the Cornwall Lent Assizes, 1852 (*Reg.* v. *Pascoe*), the accused, a medical man, was convicted and sentenced to transportation for administering *oil of savin* to a female, with intent to procure miscarriage. The proof of intent rested partly on medical and partly on moral circumstances. It appeared that the prisoner had given fourteen drops of the oil, divided into three doses, daily—a quantity which, according to the medical evidence at the trial, was greater than should have been prescribed for any lawful purpose. The medicinal dose, as an emmenagogue, on the authority of Christison, is from two to five *minims*, and according to Pereira from two to six *drops*. The quantity given by the prisoner, although a full dose, was not, therefore, greater than these authorities recommend; and his criminality appears to have rested not so much on the dose given, as on the question whether he knew or, as a medical man, had reason to *suspect* that the female for whom he prescribed it was pregnant. No medical authority would recommend oil of savin in full doses for *pregnant* females; and with regard to the existence or nonexistence of pregnancy in a special case, medical men are reasonably presumed to have better means of satisfying themselves than non-professional persons. The prisoner's innocence, therefore, rested on the presumption that he implicitly believed what the prosecutrix told him regarding her condition,—that he had no reason to *suspect* her pregnancy, and therefore did not hesitate to select and prescribe a medicine which certainly has an evil reputation, and is rarely used by regular practitioners. According to the evidence of the prosecutrix, she informed the prisoner that she had disease of the heart and liver, and that nothing more was the matter with her. It is absurd to suppose that oil of savin would be prescribed by a medical man for such a disease as this. The prisoner, on the hypothesis of innocence, must have intended the medicine to act on the uterus, and must have inferred the existence of an obstruction of menstruation from natural causes irrespective of pregnancy. The jury do not appear to have given him credit for such ignorance of his profession, and this probably led to his conviction. There can, it appears to me, be no doubt that the oil was administered with a guilty intention. Every qualified practitioner, acting *bonâ fide*, would undoubtedly satisfy himself that a young female whose menses were obstructed was *not* *pregnant*, before he prescribed full doses of this oil three times a day, or he would fairly lay himself open to a suspicion of criminality. If pregnancy—a frequent cause of obstructed menstruation—were only *suspected*, this would be sufficient to deter a practitioner of common prudence from prescribing, in any dose, a drug which may exert a serious action on the uterine system. (A report of the case of Mr. Pascoe will be found in the 'Med. Times and Gazette,' April 17, 1852, p. 404.)

The oil of savin is obtained by the distillation of the tops in the proportion of about 3 per cent. by weight. It has a yellowish colour, and the peculiar terebinthinate odour of the plant, by which alone it may be recognized. It may be separated from the contents of the stomach by agitating them in a bottle with its volume of ether, in which the oil is very soluble. The ether may be afterwards removed by distillation. The oil of savin forms a turbid mixture with alcohol (·826). When treated with its volume of sulphuric acid, it acquires a dark-brown colour, and when this mixture is added to distilled water, a dense white precipitate is separated. The odour is the best test.

Oil of tansy.—Dr. Hartshorne, an American physician, states that in the United States the *oil of tansy (Tanacetum vulgare)* has acquired the character of a popular abortive, and has caused death in several instances. In England this oil and the herb have been chiefly employed for the purpose of expelling worms. Dr. Pereira quotes a case in which half an ounce of the oil proved fatal. The symptoms were spasms, with convulsive movements and impeded respiration; no inflammation of the stomach or bowels was discovered upon dissection. ('Mat. Med.' vol. 2, pt. 2, p. 26.) The cases referred to by Dr. Hartshorne are—1. A teaspoonful of the volatile oil was taken by a girl in mistake for the essence. She complained of giddiness, and became insensible in ten minutes: convulsions came on, with frothing at the mouth, difficult respiration, and irregular pulse, and she died in one hour after taking the oil ('Amer. Jour. Med. Sci.' July, 1852, p. 279.) 2. The second case occurred to Dr. Dalton, and is reported by him in the same journal for January 1852, p. 136. A healthy-looking girl, æt. 21, took eleven drachms of oil of tansy about six hours after a hearty dinner. She was found insensible and in convulsions soon after she had taken the drug. She died in three hours and a half. A strong odour of tansy was observed in the breath before death, and on inspection in the peritoneal cavity, stomach, and even the interior of the heart. The uterus contained a well-formed fœtus about four months old, which did not, either in itself or its membranes, present any evidence of having been disturbed. 3. In a third case (reported in 'Amer. Jour. Med. Sci.' for May 1835) a woman but a few weeks pregnant took half an ounce of the oil, and did not entirely lose her consciousness until three-quarters of an hour had elapsed, although she was convulsed at intervals before that time. She died, without abortion being produced, within two hours after taking the poison. (For another case see 'Med. Times and Gazette,' April 13, 1861.) These facts show, that while oil of tansy possesses no specific action on the uterus as an abortive, and does not even affect this organ or its contents by sympathy, it is capable of acting as a powerful poison on the brain and nervous system, and of destroying life rapidly. The oil would be easily recognized, either before or after distillation of the contents of the stomach, by its peculiar and penetrating odour. It is very soluble in ether, and this may be employed for its separation.

Saffron, a decoction of the dried stigmas of saffron (*Crocus sativus*), has been employed as a popular abortive. Dr. Thomsen of Schleswig has reported a case in which abortion occurred in a woman who had taken repeated doses of a decoction of saffron with starch. There was reason to believe, however, that manipulations *per vaginam* had also been resorted to, and these may have had the principal share in bringing about the result. (Horn's 'Vierteljahrschrift,' Oct. 1864, p. 315.) According to Pereira, although saffron was formerly used as an emmenagogue and to promote uterine contractions, it is not established by any trustworthy observations that it possesses any medicinal properties. ('Mat. Med.' vol. 2, pt. 1, p. 219.) In modern medicine its chief use is to give colour and flavour to liquids. It has been observed, that when administered to pregnant females, the yellow colouring-matter has been absorbed, and the fœtus in utero has been stained by it. This appearance in the body of the fœtus might lead to a suspicion of its use, although no injury to the woman may have resulted.

It is remarkable that the action of the most powerful mineral irritant poisons have sometimes failed to affect the gravid uterus. In July 1845, a case was referred to me for examination by Mr. T. Carter, of Newbury, in which a female, aged 22 years, who had passed the fifth month of pregnancy, took a large dose of arsenic, and died in less than seven hours, having suffered from severe vomiting and purging during that time: yet abortion did not take place! The effects of mineral substances upon the body have been fully described in the section on POISONING. Among them, attention may be specially directed to the action of muriate of iron. (See p. 258.) In a case tried at the Lincoln Summer Assizes, 1863 (*Reg.* v. *Rumble*), the prisoner, a druggist, was convicted of supplying this compound for the purpose of procuring the abortion of a pregnant woman. It had not that effect, but it very seriously injured her health: the prisoner also gave cantharides in pills. In reference to the medicinal use of mercury, it may be proper to state that Dr. Salomon has reported two cases, in which premature delivery appeared to follow the mercurialization of the system. (Casper's 'Wochenschrift,' June 1845; 'Med. Gaz.' vol. 36, p. 658).

Local applications.—In a case which occurred in France, it was proved that abortion had been caused by the injection of some corrosive and irritating substance into the vagina. The female genitals, as well as the abdominal viscera, were found in a high state of inflammation. ('Med. Gaz.' vol. 37, p. 171.) This is an unusual mode of perpetrating the crime, but it is one which can hardly escape detection. An analysis of the tissues might be required, in order to determine the nature of the substance used. It appears from a trial which took place at the York Summer Assizes, 1853, that this mode of attempting to produce criminal abortion has been the subject of a prosecution in this country. It was established by the evidence that some liquid was injected into the vagina by a syringe, but there was no proof of the nature of this liquid; and as it was not shown to be of a *noxious* nature, the learned judge who tried the case directed an acquittal. ('Lancet,' July 23, 1853, p. 89.) But abortion may be induced by the frequent injection of water alone.

Signs of abortion in the living and dead.—These have been already considered in a previous chapter. (See 'DELIVERY,' *ante*, pp. 761 and 766.) The examination may extend to the female either living or dead. In the former case there will be some difficulty, if the abortion has occurred at an early period of gestation, and several days have elapsed before the examination is made; in the latter case the investigation is not always free from difficulty. One fact here requires to be especially noticed. It is now believed by many physiologists that menstruation is a state in some measure vicarious to conception, and the appearances presented by the generative organs during the menstrual period are somewhat similar to those which are observed after conception in its early stage. Mr. Whitehead remarks, that in persons who have died while the menses were flowing, the uterine walls were thickened and spongy, and the mucous lining was more or less swollen and suffused. The neck and lips of the uterus were swollen, the orifice was open, and the vaginal membrane and clitoris involved in the increased action. One of the ovaries was found larger and more congested than ordinarily, presenting evidences of the recent escape of an ovum. ('On Abortion,' p. 196.) Unless these facts are attended to, an examiner may form an erroneous opinion respecting the chastity of a deceased female. For some remarks on the mode of conducting the examination of the woman, and of the embryo or fœtus in cases of abortion, see 'Annales d'Hygiène' for 1856 (vol. 1, pp. 149 and 153).

Important questions may arise when it is alleged that abortion has been caused by the use of instruments, and death is referred to peritonitis as the result of their employment. In these cases a medical opinion should not be based upon the statements either of the female or of her friends, but upon some distinct and satisfactory medical proofs that mechanical violence has been done to the uterus, its contents, or its appendages. Peritonitis, or inflammation of the lining-membrane of the abdomen, may arise from a variety of causes. If we assign it to a particular cause, and thus implicate another in a felonious charge, we should do this only upon medical facts obtained by an examination of the dead body: we should deal with such cases as if we knew nothing of their history. In May 1863 I was consulted by Mr. Lewis, coroner for Essex, in reference to the death of a woman named *Susannah Barker*. It was supposed that her death had been caused by attempts made to produce criminal abortion. It appeared that, after three days' illness, deceased was taken in labour and was delivered of a dead child, which was between the sixth and seventh month of uterine age. She died a few hours afterwards. On an inspection of her body, it was found that the cause of death was peritonitis. She had previously complained of great pain in her abdomen, and there was no doubt that peritonitis was developed before she was delivered; in fact, the peritonitis appeared to be the direct cause of the abortion. She admitted to her medical attendants that she had taken some powders to cause miscarriage, and, further, that a person calling himself a medical man had, about a week before, introduced two instruments into her body which had caused her great pain. Besides extreme inflammation of the peritoneum, which was the direct cause of death, the heart, lungs, and stomach were healthy, and the uterus presented no appearances excepting those arising from recent delivery; it was perfectly natural, and free from all marks of injury. There was no injury to the vagina, nor any wound in the peritoneum itself. There was no mark of violence on the body of the child; in short, this could have sustained no injury, as the membranes surrounding it were not ruptured. The medical gentleman who examined this case thought that the fatal peritonitis had been caused by the introduction of instruments into the vagina, and that this might occur without leaving after death any traces of their employment. At the same time it was admitted that a speculum used in the ordinary way would not produce peritonitis, and it was alleged in defence that a speculum only had been used.

The connection of the peritonitis with the alleged manipulations of the unlicensed practitioner rested more on surmise than proof. The absence of any bruise, puncture, or laceration affecting the vagina, uterus, or fœtus, with the fact that, whatever may have been the instruments used, the membranes were left entire, rendered it impossible to assign the peritonitis with absolute certainty to the acts of the person who was charged with causing the death of the woman. For anything that appeared to the contrary he might have used a speculum, and it is well known that this instrument, although frequently introduced into the vagina, does not cause peritonitis. The connection of the peritonitis with instrumental violence, therefore, was not in this case established, and the jury by their verdict discharged the suspected person. They could do no otherwise, for there was not the slightest *medical* proof that any improper instrument had been introduced into the vagina with felonious intention.

Feigned abortion.—For various motives, into the consideration of which it is unnecessary to enter, a woman may charge another with having attempted or perpetrated the crime of abortion. Such a charge is not common, because, if untrue, its falsity may be easily demonstrated. A young woman, admitted into Guy's Hospital in April 1846, charged a policeman (who, according to her statement, had had forcible intercourse with her) with having given her some substance to produce abortion, and with having subsequently effected this mechanically. She was not examined until nearly two months after the alleged perpetration of the crime, when the late Dr. Lever found that there was no reason to believe she had ever been pregnant. This was a case of feigned abortion. When charges of this serious kind are brought forward, they are always open to the greatest suspicion, unless made immediately after the alleged attempt, as it is then only that an examination can determine whether they are true or false. If so long delayed, as in this instance, without any satisfactory reason, the presumption is that they are false.

Legal relations.—In the statute for the consolidation of the criminal law (24 and 25 Vict., chap. 100., ss. 58 and 59), the nature of this crime, and the proofs required to establish it, have been more explicitly stated than in former Acts. By clause 58 (on attempts to procure abortion), it is enacted that 'Every woman, *being with child*, who, with intent to procure her own miscarriage, shall unlawfully administer to herself any poison or other noxious thing, or shall unlawfully use any instrument or other means whatsoever with like intent, and whosoever, with intent to procure the miscarriage of any woman, *whether she be or be not with child*, shall unlawfully administer, &c., shall be guilty of felony.' Formerly, women who endeavoured to produce abortion in themselves were not guilty of any offence against the law.

In *Reg.* v. *Warboy* (Cent. Crim. Court, August 1862), the prisoner, a widow, was convicted as an accessory before the fact to the felonious using by one Morgan of a certain instrument upon herself with intent thereby to produce miscarriage.

The latter portion of clause 58 makes it immaterial whether the woman were or were not with child, in accordance with the decision of the judges in *Reg.* v. *Goodhall* (1 Den. C. C. p. 187), and *Reg.* v. *Goodchild* (2 C. and K. p. 293). Clause 59 is to the following effect:—'Whosoever shall unlawfully supply or procure any poison or other noxious thing, knowing that the same is intended to be unlawfully used or employed with intent to procure the miscarriage of any woman, whether she be or be not with child, shall be guilty of a misdemeanor; and being convicted thereof, shall be liable, at the discretion of the Court, to be kept in penal servitude for the term of three years, or to be imprisoned for any term not exceeding two years.' This clause is intended to check the obtaining of poison, &c. for the purpose of causing abortion, by making both the person who supplies and the person who procures it guilty of misdemeanor. It will be observed, in reference to these clauses, that the *means* employed, whatever their nature, must have been used with an *intent* to procure the miscarriage of a woman,—a point which will be sufficiently established by a plain medical statement of the means employed. Supposing that a drug has been used, the witness will have to state whether it is 'a poison or other *noxious* thing'; for this must be proved in order that the prisoner should be convicted of the crime. I must refer the reader to what has been said elsewhere (*ante*, p. 131), in order that he may be able to judge how far the substance administered would fall under the description above given. Whether the substance would or would not have the effect intended, *i. e.* of inducing abortion, is perfectly immaterial. Some uncertainty may exist as to the strict meaning of the word *noxious*:—all will allow that the word implies something injurious to the system, but a difference of opinion may arise among medical witnesses with respect to its application to the substance under discussion,—as, for example, with respect to rue or savin. (See p. 132.) A substance must be regarded as injurious to the body, or noxious, either according to the form, quantity, or frequency with which it is administered. Savin, ergot, and rue are irritant; and they become noxious when given in large doses, or in small doses frequently repeated. ('Ann. d'Hyg.' 1838, vol. 2, p. 180.) Aloes and castor-oil are innocent when taken in small doses; but they acquire noxious or injurious properties when administered frequently, or in large quantity, to a pregnant female. To confine the term 'noxious,' therefore, to what is strictly speaking a poison *per se*, would be giving a latitude to attempts at criminal abortion, which would render the law inoperative. (See the case of *Reg.* v. *Stroud*, Abingdon Sum. Ass. 1846.) The small quantity of the substance taken at once does not affect the question, provided the dose be frequently repeated. A case in which I was consulted by Mr. Reynolds (a former pupil) was tried at the Exeter Winter Assizes, 1844. Two powders, weighing each one drachm, were prescribed by the prisoner: one consisted of colocynth, the other of gamboge, and with them was half an ounce of a liquid (balsam of copaiba.) They were to be mixed together, and a fourth part to be taken four mornings following. Mr. Reynolds said, in answer to the question whether such a mixture was noxious or injurious, that each dose would be an active purgative, and might thereby tend to produce abortion. One dose would not be productive of mischief in a healthy countrywoman, but its frequent repetition might lead to serious consequences. In a trial which took place at the Norwich Lent Assizes, 1846 (*Reg.* v. *Whisker*), it was proved that the prisoner had caused to be taken by the prosecutrix a quantity of *white hellebore*, in powder, for the purpose of procuring abortion. One medical witness said he considered hellebore to be noxious to the system, but he knew of no case in which it had produced death; and under these circumstances he did not consider himself justified in calling it a poison. Another medical witness stated that, in his opinion, it belonged to the class of poisons. The judge, in summing up, told the jury that *that* was to be regarded as a poisonous drug which, in common parlance, was generally understood and taken to be such; and he thought the evidence sufficiently strong to bring hellebore within the meaning of the statute. The jury found the prisoner guilty, alleging that in their belief white hellebore was a poison. ('Med. Gaz.' vol. 37, p. 830.) The only circumstance calling for remark in this case is, that any doubt should have been entertained by a medical practitioner respecting the poisonous properties of white hellebore. It is a powerful vegetable irritant, and has caused death in several instances; yet on this occasion it appears to have been admitted to be *noxious*, but not *poisonous!* The nature of the substance administered, and that it is *noxious*, should be proved. No speculative evidence is favourably received when some portion of the substance cannot be procured. In *Reg.* v. *Taylor* (Exeter Winter Ass. 1859) some powders had been given by the prisoner to a girl with the view of inducing abortion. No portion of the powders could be obtained for examination: but two medical gentlemen who heard the evidence gave their opinion that the powders were of a noxious nature. In the defence, it was urged that this had not been proved. The jury adopted this view, and returned a verdict of acquittal.

In reference to the proof of this crime, it is not required, under the circumstances, that any specific injury should have been done to the woman, or that abortion should have followed in order to complete the offence. There is every reason to believe that the crime is frequent, but its perpetration is secret. Applications are continually made to druggists by the lower class of people for drugs for this purpose: the applicants appear to have no idea of the criminality of the act. (See, in reference to the frequency of this crime, a paper in the 'Medical Gazette,' vol. 46, p. 487; also 'Med. Times and Gaz.,' Nov. 21, 1857, pp. 524, 537.)

On inducing premature labour. Medical responsibility.—It may be proper to offer here a few remarks upon the common practice of inducing *premature labour*, in certain cases of disease, of deformity of the pelvis, and in cases of excessive vomiting from pregnancy. This practice has been condemned as immoral and illegal; but it is impossible to admit that there can be any immorality in performing an operation to give a chance of saving the life of a woman, when, by neglecting to perform it, it is almost certain that both herself and the child will perish. (See, on the morality, safety, and utility of the practice, Ramsbotham's 'Obstet. Med.,' p. 315.) The question respecting its illegality cannot be entertained; for the means are administered or applied with the *bonâ fide* hope of benefiting the female, and not with any criminal design. It is true that the law makes no exception in favour of medical men who adopt this practice, nor does it in the Statute of Wounding make any exceptions in favour of surgical operations; but that which is performed without evil intention would not be held to be unlawful. The necessity for the practice ought to be apparent: thus, for instance, it should be shown that delivery was not likely to take place naturally, without seriously endangering the life of a woman. It is questionable whether, under any circumstances, it would be justifiable to bring on premature expulsion, merely for the purpose of attempting to save the life of a child, since the operation, unless performed with care, is accompanied with risk to the life of the mother. The grounds upon which many eminent authorities have objected to this practice are:—1. That there are few cases in which parturition, if left to itself, might not take place at the full period; 2. The toleration of the practice would lead to great criminal abuse; 3. It is attended with danger to the mother and child. It is undoubtedly true that parturition will sometimes take place safely at the full time, even when the deformity of the pelvis is apparently so great as to lead many accoucheurs to suppose natural delivery to be utterly impossible. Dr. Lilburn has reported the case of a female who laboured under great deformity of the pelvis, but who was twice delivered in safety, and the child survived. ('Med. Gaz.,' vol. 19, p. 933.) It is therefore not improbable that many cases of the kind are prematurely treated, which, if left to themselves, would probably do well without interference. Hence a cautious selection should be made, because the operation is necessarily attended with some risk,—it does not insure safety to the woman and child. All that we can say is, that, according to general professional experience, it places her in a better position than she would be in if the case were left to itself. It appears to me that before a practitioner resolves upon performing an operation of this kind he should hold a consultation with others; and, before it is performed, he should feel well assured that natural delivery cannot take place without greater risk to the life of the mother than the operation itself would create. These rules may not be observed in practice; but the non-observance of them is necessarily attended with some responsibility to a practitioner. In the event of the death of the mother or child, he exposes himself to a prosecution for a criminal offence, from the imputation of which even an acquittal will not always clear him in the eyes of the public. If the child were born alive, and died merely as a result of its immaturity, this might give rise to a charge of manslaughter. Within a recent period several practitioners have been tried upon charges of criminal abortion,—whether justly or unjustly it is not necessary to consider; but they had obviously neglected to adopt those simple measures of prudence, the observance of which would have been at once an answer to a criminal charge. Because one practitioner may have frequently and successfully induced premature labour, without observing these rules, and without any imputation on his character, this cannot shield another who may be less fortunately situated. A charge is only likely to arise when a man has been unfortunate, and the responsibility of one operator cannot be measured by the success of others.

A case occurred at Portsmouth in 1848, in which a female died from loss of blood, which took place during an attempt to induce premature labour. A small aperture was discovered after death in the left common iliac artery, and more than a pound of blood had been effused. This was ascribed to a thinning of the coats of the artery, and not to a puncture of the vessel during the operation. (See 'Lancet,' July 22, 1848, p. 107.) For some judicious remarks on the induction of premature labour, by Dr. Radford, see 'Med. Gaz.,' vol. 47, p. 583.

As in the law of England so in the law of France proof of pregnancy is not essential to the crime of abortion. Dr. Bayard relates a case in which a woman was convicted, in 1846, of an attempt to induce abortion in a female who was subsequently proved not to be pregnant, but to be labouring under ovarian disease. The prisoner was sentenced to eight years' imprisonment. ('Ann. d'Hyg.,' 1847, vol. 1, p. 466.)

Abortion of monsters.—Would the law be applicable to cases in which the child was dead in the uterus, or in which it was a monster without human shape? The symptoms indicative of the death of the child in utero have been elsewhere stated (INFANTICIDE). Its death subsequently to the attempted abortion might perhaps be adduced as corroborative evidence of the crime; but, even if it were dead at the time of the attempt, the offence would be completed. It cannot be doubted that the expulsion of a dead child would come under the popular signification of a *miscarriage*; and if the words were strictly interpreted, a prisoner might be convicted whether the child were living or dead, for it has been already stated that it is not necessary that any abortion should have taken place. With respect to *monsters*, the question actually arose in a case tried at Drôme, in France, in 1841. ('Gaz. Méd.' Juillet 1841; also 'Brit. and For. Med. Rev.,' vol. 24, p. 563.) A girl was accused of procuring abortion. The aborted fœtus, of about the sixth month, was without a head (acephalous), and there was no vertebral canal for the spinal marrow. Other organs were also deficient or imperfectly formed. The medical witnesses had declared that it had never breathed, and that its life had ceased with gestation. On the upper part of the body was a wound, which had been produced by a pointed instrument, probably just before it was expelled: this they thought had caused death. The counsel for the prisoner contended that this could not be regarded as a case of criminal abortion, owing to the monstrosity of the offspring; and the jury acquitted her. As proof of pregnancy is no longer required, monstrosity in the fœtus should make no difference in the nature of the crime.

Extra-uterine conceptions.—Would the law apply to cases of extra-uterine pregnancy? There can be no doubt that the crime of abortion would apply to cases of this description; and a person would be equally amenable for the attempt, whether the fœtus was in the uterus or in the Fallopian tube. The symptoms of extra-uterine pregnancy, especially of the tubal kind, are similar to those of ordinary pregnancy, and are not to be distinguished from them in the early stages (see 'Med. Gaz.,' vol. 36, p. 103). For a case of attempting to procure abortion with extra-uterine conceptions, see 'Obstetric Transactions' (vol. 5).

Abortion of moles.—The use of the word *miscarriage* in the statute, without any explanation of the meaning assigned to it, might, but for the decision in *Reg.* v. *Goodhall* (Notts Lent Assizes, 1846), have created some difficulty on trials for abortion. In a popular sense (and here a *popular* appears to have been purposely selected in preference to a medical term), miscarriage signifies the violent expulsion not merely of a child but of moles and other diseased growths, or even of coagula of blood. In these last-mentioned cases, the woman is not actually pregnant, although she and the accused may imagine that she is. But whether the uterus contains these morbid growths, or whether it is in the virgin state, the party who has used the means with *intent* may still be convicted of an attempt to procure abortion.

Chemical evidence. Blood in abortion. Liquor amnii.—In the event of an abortion having taken place, stains produced by blood or by the waters (liquor amnii) may be found on the linen of a female, and a practitioner may be required to say whether these stains are of a nature to throw any light upon the perpetration of the crime. A female who has aborted may allege that the stains are those of the menstrual discharge. Speaking generally, there is no practical distinction between menstrual and other blood (see p. 453). The menstrual blood contains less fibrin, is commonly acid and watery from admixture with the mucous discharges, and when examined by the microscope it presents epithelial scales, or cells derived from the mucous membrane. These scales or cells belong to the columnar variety. (See Rape, *post.*) Not much reliance can be placed upon their discovery, since the mucous membrane of the organs of respiration is lined with similar cells. Hence expectorated blood might be mistaken for menstrual. Cells of a similar shape line the whole of the mucous membrane from the stomach to the anus. The blood of piles might thus be confounded with menstrual blood. The blood discharged in abortion will present the usual characters of blood, elsewhere described (pp. 443, 453); but it may be diluted by the waters simultaneously discharged. This question received the special attention of the French Academy a few years since, in reference to the crime of abortion; and the report made was to the effect that in the present state of science there was no certain method by which the blood of menstruation could be practically distinguished from the blood discharged from a female in a case of abortion or infanticide ('Ann. d'Hyg.' 1846, vol. 1, p. 181). In a more recent case, MM. Devergie and Chevallier were required to state whether certain stains on the dress of a female, supposed to have aborted, were or were not caused by the waters (liquor amnii). A chemical analysis merely revealed the presence of an albuminous liquid. The most elaborate experiments satisfied the reporters that neither by the odour, nor by any other process, could the liquor amnii, dried on linen, be identified. (See 'Ann. d'Hyg.,' 1852, vol. 2, p. 414.) It may, however, be of importance to observe that this liquid slightly discolours and stiffens the fibre of the stuff on which it has been effused, and that it can be readily extracted by cold water. The solution possesses all the properties of albumen. The amount of albumen contained in the liquor amnii decreases as gestation advances. At the fourth month it forms 10·77 per cent. of the liquid; at the fifth month 7·67; at the sixth month 6·67; and at the ninth month only 0·82 per cent. M. Chevallier's experiments show that the amniotic liquid has all the usual chemical properties of a very diluted solution of albumen ('Ann. d'Hyg.,' 1856, vol. 1, p. 156).

BIRTH. INHERITANCE.

CHAPTER 62.

EVIDENCE OF LIVE BIRTH IN CIVIL CASES—LEGAL RIGHTS OF THE FŒTUS IN UTERO—DATE OF BIRTH—DIFFERENCES BETWEEN ENTIRE AND PARTIAL BIRTH—SIGNS OF LIVE BIRTH INDEPENDENT OF RESPIRATION OR CRYING—MOTION OF A LIMB, OR PULSATION OF THE CORD, A PROOF OF LIVE BIRTH—VAGITUS UTERINUS—TENANCY BY COURTESY—CÆSAREAN EXTRACTION OF CHILDREN—LEGAL BIRTH—POST-MORTEM BIRTHS—MINORITY AND MAJORITY—MEDICAL EVIDENCE IN RELATION TO PLURAL BIRTHS—MONSTERS—WHAT CONSTITUTES A MONSTER IN LAW—DEPRIVATION OF LEGAL RIGHTS—DOUBLE MONSTERS—CHRISTINA RITTA—THE SIAMESE TWINS.

Live birth in civil cases.—The law of England has not defined the meaning of the term Birth, in reference to civil jurisprudence; but if we are to be guided by the numerous decisions which have been made on trials for infanticide, it must be regarded as signifying 'the entire delivery of a child,' with or without its separation from the body of the mother. (See INFANTICIDE; see also Chitty, 'Med. Jur.,' 412.) So long as an infant remains in the uterus it is said in law to be '*in ventre sa mère*'; but it is legally supposed to be born for many purposes. ('Blackstone's Comm.,' vol. 1, p. 130.) A child in the womb may have a legacy or an estate made over to it,—it may have a guardian assigned to it; but none of these conditions can take effect unless the child is born alive. So the fœtus may be made an executor; but it is very properly provided that an infant cannot act as such until it has attained the age of seventeen years! The Roman and English systems of law apply the same term (*venter*) to the unborn child; when born dead it is called *abortus*, abortion; when alive, *partus*, *infans*, infant.

Date of birth.—Medical evidence has occasionally been demanded in Courts of law respecting the actual date of birth of individuals, in cases in which a period of a few days, hours, or even minutes was required to prove the attainment of majority,—and therefore a legal responsibility for the performance of civil contracts into which the parties had entered, either knowingly or ignorantly, when minors. Some such cases have been decided by the evidence of the accoucheur himself,—others, when the accoucheur was dead, by the production of his case-books; and it is worthy of notice that the strictness and punctuality of some medical practitioners, in making written memoranda of cases attended by them, have in more than one instance led to a satisfactory settlement of such suits, and the avoidance of further litigation. The proof of the exact date of birth is also of considerable importance in certain cases of contested legitimacy.

The most important medico-legal questions connected with this subject are those which arise in contested suits relative to succession, or the inheritance of property. A child that is born alive, or has come *entirely* into the world in a *living* state, may by the English law inherit and transmit property to its heirs, even although its death has immediately, and perhaps from morbid causes necessarily, followed its birth. Should the child be born dead, whether it died in the womb or during the act of birth, it does not acquire any civil rights; for it is not regarded as a life in being, unless it manifests some sign of life *after* it is entirely born and separated from the mother. Some have considered that *partial birth*, provided a child is living, should suffice to confer the same rights on the offspring as the proof of entire birth. The following case has been adduced by Sir C. Locock in support of this view, although the question here was rather in reference to the actual date of birth than to the acquisition of civil rights therefrom: the principle is, however, the same. On a Saturday evening a lady was in labour with her first child. The head and one arm were born two or three minutes before a neighbouring clock struck 12. There was a cessation of pain for several minutes, during which time the child cried and breathed freely. The rest of the body was not expelled until full five minutes after the same clock had struck twelve. Was this child born on the Saturday or on the Sunday? Certainly the birth was not completed until the Sunday: the child was still partly within the body of the mother—the circulation was still kept up through the umbilical vessels: 'but,' continues Sir C. Locock, 'I gave my opinion that the child was born on the Saturday. I considered that the child had then commenced an independent existence. The fœtal life had then to all intents and purposes ceased; and breathing—a function incompatible with the condition of a fœtus—had commenced. The navel-string will, it is true, go on pulsating for many minutes after an infant has been brought completely into the world, crying and kicking, unless it be compressed artificially; and yet no one will say that a child in such a case is not born until we choose to take the trouble to tie the navel-string. The child would not have been damaged if it had remained for hours, or even days, with merely its head and arms extruded: it could have been fed in this situation.' ('Med. Gaz.' vol. 12, p. 636.) However reasonable, *medically* speaking, this view may appear, a medical jurist must shape his evidence according to what the law demands. It has been elsewhere stated (Infanticide), that our judges have distinctly laid down the law that no child can be considered to be *legally* born until the *whole* of its body has come *entirely* into the world. This is in relation to criminal jurisprudence, in which case, if in any, the rule should be relaxed, because its relaxation would tend to punish the wilful destruction of living infants partially born. This child could not, therefore, have been born on the Saturday, because the law does not regard partial birth as entire birth; and respiration and birth are not synonymous terms. Supposing this child to have died before its body was entirely extruded, it could not be said, even medically, that it was born alive; and certainly it could not be considered, according to the present state of the law, to have acquired the rights of a child born living. The reasonableness of the opinion that partial birth should suffice for all the legal purposes of entire birth is a distinct question, and one over which a medical witness has no sort of control. Whatever apparent injustice may be done by adhering to this rule in respect to the civil rights of persons, there is no doubt that the evil is really of great magnitude in relation to criminal jurisprudence; for it would appear, from the present state of the criminal law, that the destruction of partially-born children, although alive and healthy, is not, legally speaking, child-murder.

On the other hand, some difficulty might arise in civil cases, if the bare extrusion of a *part* of the body sufficed for all the legal purposes of *entire* birth. It might become a casuistical question, as to how much of the body should be in the world in order to constitute legal birth; for there is no reason why, in a medical view, the extrusion of the head and shoulders should constitute birth any more than the extrusion of a hand or a foot. If it be said that the act of breathing should be combined with a partial extrusion of the body, this would be unjust; because a child is alive—its heart is evidently pulsating, and its blood circulating, as freely before the act of breathing as afterwards. Besides, it is admitted that children may be born alive, and live for some time, without respiring; and this want of respiration is no objection to these children being considered living in law. In cases referred to hereafter (pp. 797, 798), a child was legally pronounced to have been born alive, although it had certainly not respired; and that a child may manifest life for a certain time without leaving in its body any evidence of respiration is clear from numerous reported cases. If, then, proof of respiration be not demanded in cases of entire, it could scarcely be required in cases of partial birth. In the event of partial being treated as synonymous with entire birth, there would be no end to litigation; and medical opinions would vary in every case. It is doubtful whether, under such circumstances, the law could be administered with any degree of certainty or impartiality. Admitting, then, that a child must be *entirely* born in order that it should acquire civil rights, it will next be necessary to examine the medical proofs required to show that it has been *born alive.* The question here is different from that of live birth in reference to child-murder. We must presume that a practitioner is present at a delivery in which a child is born in a doubtful state, or where its death speedily follows its birth. The civil rights of the child and its heirs will depend upon the careful observation, made by a practitioner, of the circumstances attending the delivery. It is proper that he should note when the birth is completed, by the body of the child being entirely out of the body of the mother. Children born at or about midnight are thus liable to have the date of birth wrongly registered; and the legal difference of twenty-four hours, which a few seconds or minutes may make, may hereafter affect their own rights if they survive, or those of others if they die. The birthday of the late illustrious Duke of Wellington was entered in the parish register as the 30th of April 1769, while there is abundant evidence for fixing it on the 1st of May; in fact, he was born just after 12 o'clock in the night between the 30th of April and the 1st of May. Nothing can be more simple than for an accoucheur to fix the true date, not by the hour at which labour commences, but the time at which it is completed.

Signs of live birth independently of respiration or crying.—The visible respiration of a child after its birth, or as it may be manifested by its *crying*, is an undoubted sign of its having been born alive; but, as it has just been stated, a child may acquire its civil rights, although it may be neither seen to breathe nor heard to cry. The pulsation of a child's heart, or even the spasmodic twitching of any of the muscles of the body, has been regarded as a satisfactory proof of live birth. The latter sign has been judicially so pronounced—*à fortiori*, therefore, the motion of a limb will be considered sufficient legal evidence, in an English Court of law, of life after birth. It is to be observed that the length of time during which these signs of life continue after a child is born is wholly immaterial: all that is required to be established is, that they were positively manifested. A child which survives entire birth for a single instant acquires the same civil rights as if it had continued to live for a month or longer. In the case of *Fish* or *Fisher* v. *Palmer*, which is reported to have been tried in the Court of Exchequer in 1806, it was decided, upon the opinions of Drs. Babington and Haighton, that a tremulous motion of the lips of a child *after* its birth (while immersed in a warm-bath) was sufficient evidence of live birth in law to transfer the estate of the wife to the husband as tenant by courtesy. Dr. Denman gave a contrary opinion, and assigned the motion of the lips to the remains of uterine or fœtal life.

A question of this nature involves the strict meaning of the term *life* in a physiological sense, and a definition of the properties of *dead* as contrasted with those of *living* muscular fibre. The earliest record which I have been able to find of the case of *Fish* or *Fisher* v. *Palmer* is in Foderé ('Traité de Médecine

Légale,' 1813, vol. 2, p. 160). It has been quoted in the works of Gordon Smith, Beck, Paris and Fonblanque, and other medico-legal writers since that time. The correctness of the decision in this case has not only been challenged, but its actual occurrence has been doubted. It has been contended that there should be, in all cases, evidence not only of the breathing, but of the crying of a child, in order to justify a medical opinion that it was born alive; but according to Blackstone (' Commentaries,' vol. 2, ch. 8, p. 127), ' *Crying*, indeed, is the strongest evidence, but it is not the *only* evidence': and Coke says, ' If it be born alive it is sufficient, though it be not heard to cry, for peradventure it may be born dumb'; he also describes '*motion*, stirring, and the like', as proofs of a child having been born alive. So far the decision in *Fish* v. *Palmer* is borne out by good legal authority; and we may consider that although the mere warmth of the body would not be evidence of live birth, yet the slightest trace of *vital* action, in its common and true physiological acceptation—such as crying, breathing, pulsation, or motion—observed after entire birth and separation from the mother, would be deemed in law a sufficient proof of the child having come into the world alive. (See a case decided adversely to this view in France: ' Ann. d'Hyg.' 1832, vol. 1, p. 98.)

A late eminent Scotch judge informed me that in Scotland the husband's right of courtesy, or life-rent in his wife's estate, depends on there having been a child of the marriage born alive; and for the proof of live birth it is required to be shown, not merely that it had breathed, but that the child had cried after it was born. (Case of *Dobie* v. *Richardson*, Court of Session, 1765.) The last case of this kind came before the Courts in 1833, and by a majority their lordships adhered to the old dicta of the law, and decided that the only receivable proof of life in such a case was that the child had *cried*. They found that proof that the child was capable of motion, and that it had breathed for three-quarters of an hour, was not sufficient to establish life unless the child had cried! There is reason to believe that, in any future case, this will not be taken as a precedent. The attainment of greater knowledge on the nature and the proofs of life from the results of medical experience and observation, and the fact that these questions have become more generally known and better understood, will probably lead to a different decision. That there should not be a power of proving life (when the death of a child takes place speedily after birth), except by direct evidence that the child had cried, is in truth a view of the matter wholly indefensible. From what will be presently said (*Vagitus uterinus*, infrà), it will be seen that the crying of a child is not necessarily a sign of live birth, for it may cry during the act of birth, and die before its body is born; while the fact that it breathes and moves after birth, although from accidental circumstances it may not cry, is unexceptionable evidence of its having been born alive.

The recent case of *Brock* v. *Kellock* involved a claim by the widow to the estate of her husband, on the ground that a child born twenty years before had been born living, although it was at first supposed to have been still-born. The case came before Vice-Chancellor Stuart in April 1861, and his decision confirmed the views here expressed. Dr. Freeman noticed at the birth of the child, and after separation from the mother, that there was a slight pulsation in the cord, showing a feeble but independent circulation in the child. There was no other indication of respiration than an arched state of the chest. This witness and Dr. Tyler Smith stated that, in their opinion, the child had been born alive. Drs. Lee and Ramsbotham affirmed that the child, in their judgment, was not born alive: and that a child must *respire* before it could be said to possess independent life. The Vice-Chancellor decided that this was not necessary, and held that there was sufficient legal evidence of life after birth in the pulsations observed by the accoucheur. This decision is in accordance with law and common-sense. Pulsations indicate an action of the heart, as much as motion of the chest indicates an action of the intercostal muscles. Why these gentlemen should have maintained that there was life with contractility of the intercostal muscles, and not with a contractile power of the heart, is not apparent; but that the opinion expressed is not in accordance with facts, is proved by cases which are described under INFANTICIDE. In one reported case pulsation was the only clear evidence of life.

A healthy full-grown child may make an attempt at inspiration, but the closure of the larynx from convulsions, or some irritant such as the vaginal discharges, meconium, &c., may impede the entry of air within the lungs. The chest in this case is arched, the head thrown back, and there is a convulsive rigidity of the muscular system; the tongue is firmly retracted, especially at its base. Unless the finger of the accoucheur be passed quickly down to the base of the tongue, and the epiglottis raised by pressing forwards, the child would never inspire, although it might have a perfect capacity to breathe. Dr. Braxton Hicks informs me that a case of recovery from this kind of affection occurred in his practice, the air entering the lungs immediately after the above operation, and the child breathed and lived. It has been observed that a respiratory action ensues upon any stoppage of the placental supply to the child, and, moreover, that this may occur in the uterus as well as in the vagina; and it has been remarked that foreign substances which had been drawn in under these circumstances, may be found in the bronchial tubes If this be so, then the finding of the natural secretions in the bronchial tubes would be no proof of respiration having been established: it would merely show that there had been an action of the chest during birth similar to that of inspiration.

There is no doubt that the best test to apply to such cases for the determination of *physiological* life is *auscultation*. The beating of the heart, as determined by the ear or the stethoscope, applied even for five consecutive minutes, is an undoubted sign of life, in a physiological sense, whether the child breathes, cries, or moves. M. Bouchut noticed, on one occasion, that this kind of passive life continued in an infant for twenty-three hours after its birth. Feeble but distinct pulsations were heard at long intervals, but there was no motion of the ribs. Attempts at resuscitation were made, but the motions of the heart became more and more feeble, until they entirely ceased. An examination showed that the lungs had not received air. As we take the cessation of the heart's action to be the only certain evidence of death, so the existence of pulsations in the heart or arteries, when clearly perceived by the ear, stethoscope, or finger, is positive evidence of life in a physiological sense. Is this *legal* life? Would the wilful destruction of such a child constitute murder? Would this proof of pulsation without muscular motion, respiration, crying, or any other sign of active life, confer tenancy by courtesy, or transfer an estate by inheritance or survivorship? M. Bouchut justly observes that apparent death succeeding to birth, and characterized by the presence of a beating of the heart and an absence of respiration, is only a diseased condition of the new-born child (see 'Atelectasis', INFANTICIDE); and, whether it is cured of this or dies, it is living, although it has not respired—or, as a German jurist remarks, '*Scheintod ist Scheinleben.*' By taking away its rights of succession, the law punishes the child and its heirs for a malady with which it is born ('Gaz. des Hôp.' 1855, No. 124; and 'Med. Times and Gaz.' Aug. 19, 1856). They who contend that crying or breathing alone should be taken as a sign of life after birth, would of course pronounce such a child to have been born *dead*, even at the time that they might be listening to the pulsations of its heart! (Casper 'Klinische Novellen,' 1863, p. 564.) Such pulsations would probably be referred by them to the remains of uterine life.

Vagitus uterinus.—Let us suppose that the evidence of a child having been born alive is stated to be that it was heard to cry—it may be a question for a medical witness, in cross-examination, whether this is to be taken as an absolute proof of live birth. The answer must be in the negative, because a child may cry before its body is entirely born; or there may have been what is called *vagitus uterinus*,—a uterine cry after the rupture of the membranes. (See INFANTICIDE.) It is quite certain that a child may breathe without crying, but it cannot cry without breathing; yet neither the crying nor the breathing is a necessary proof that the child was actually born alive. As in all cases of this description there must be eyewitnesses, either professional or not,—the evidence will not rest solely upon a mere medical possibility of the occurrence of such a cry before birth; and proof will be required of the crying of the child *after* it was born.

The determination of the momentary existence of children after birth is of importance in a legal point of view in reference to the subject of Tenancy by Courtesy.

Tenancy by courtesy.—This signifies, according to Blackstone ('Com.' vol. 2, p. 426), a tenant by the Courts of England. The nature of this tenancy has been already explained. (See the case of *Fish* v. *Palmer*, p. 797, and *Brock* v. *Kellock*, p. 798.) If a married woman possessed of estate die, the estate passes from the husband to her heir-at-law, unless there has been a child born *living* of the marriage, in which case the husband acquires a life-interest in the property. The only defence of this singular custom is, that it is of great antiquity. An unsuccessful attempt was made a few years since to substitute for it the reasonable provision, that the marriage should entitle the husband to a right, which he can now only acquire by the fulfilment of certain accidental conditions. Incurable sterility, a protracted labour, deformity in the pelvis of the wife, or the necessary performance of craniotomy on a healthy well-formed child, may, under this custom, lead to an aversion of the inheritance. The tenancy, in contested cases, is generally established or disproved by medical evidence; and the following are the conditions which the law requires in order that the right should exist:—

1. The child must be born *alive*. Cases have been already related, wherein the motion of a lip and a pulsation of the umbilical cord were held to be sufficient proofs of live birth. Some physiologists have objected to these as inadequate proofs of life; and if the question were one of physiology, and not of law, there might be some ground for the objection. In truth, however, the law does not require proof of *active* life in a child, but merely some evidence, however slight, that it has been born living; and the amount of proof to satisfy the purposes of justice must of course rest with those who are expounders of the law. Rare as these cases are, one has been the subject of two trials (*Llewellyn* v. *Gardiner and others*, Stafford Lent Assizes, 1854; and *Gardiner* v. *Llewellyn*, Stafford Summer Assizes, 1856). This was an action of ejectment brought to try the plaintiff's right to a life-interest in the property of his deceased wife. The plaintiff claimed as tenant by the courtesy of England, and his right depended upon whether his deceased wife had had a child born alive. According to the plaintiff's evidence, his wife had taken a long walk, she being at the time in about the seventh month of her pregnancy (November 1851); and, having been taken ill during the night, she was suddenly delivered of a child, which lived for about a quarter of an hour. He stated that he heard the child cry. The plaintiff immediately fetched his sister, and returned with her to his wife in a few minutes, and she deposed that she heard the child *cry* twice. This evidence was relied upon as conclusive that the child had been born alive, although it appears on the same evidence to have died before anything could be done towards dressing it. The case for the defendants at the first trial was that the wife was a girl of delicate health and liable to epileptic

fits: that when little more than 16, she had been married by the plaintiff, without the consent of her mother; and evidence was given to show the improbability of the child having been born alive, there being reason to believe, from the conduct of the plaintiff and other circumstances, that it never could have had more than a fœtal existence. There had been no medical examination: the body was buried the same day, and, as in the case of still-born children, neither the birth nor the burial was registered. Wightman, J., left it to the jury to say whether the positive evidence given by the plaintiff and his sister had been rebutted by the evidence given for the defendant and the other circumstances of the case. The jury found a verdict in favour of the husband's claim. At the second trial, ordered by the Court of Chancery (Stafford Summer Assizes, 1856), the plaintiff Llewellyn was made defendant; and medical and other evidence was adduced to show that the child could not have reached an age at which it could either breathe or cry. The age was variously assigned at the fourth or fifth month of gestation. The body of the child was not seen by any medical man, and the non-professional witnesses who saw it differed entirely regarding its size and appearance; so that, in fact, the case rested mainly on the credibility of the statements of Llewellyn and his sister. There were no *medical* facts to guide the jury. The late Baron Alderson, in summing up, said the question simply was whether Eliza Bennett, afterwards Eliza Llewellyn, was delivered of a living child during the time she was a wife. By what was called the 'Courtesy of England,' a man who married a woman possessed of freehold property, would, if she had had a child born alive during the time they were married, be entitled to the property for his life; but if she had not had a child born alive he would not be entitled to it; that was one of the absurdities of English law! In directing the jury as to the considerations that should guide them in coming to a conclusion, his lordship said they ought to have reasonable and distinct proof of a child having been born alive when its existence was limited to a few minutes; and if a doubt was left in their minds they ought not to find in favour of the birth of the child, because the issue lay to prove that the child was born alive. If they had a doubt on the subject, and could not tell whether it was born alive or not, they must find a verdict for the plaintiffs (Gardiner); they could not find for the defendant Llewellyn unless they were satisfied that the child was in a state of life in the world during the time the husband was married to the wife. The verdict of the jury was to the effect that they did not believe the child was born alive: it was, therefore, a reversal of the former verdict.

It has been usually considered that the *crying* of a child, properly attested by disinterested witnesses, is sufficient evidence of live birth. This is, in fact, one of the tests given by Lord Coke. In the section on INFANTICIDE, some cases are related in which new-born children survived birth several hours, but manifested no sign of active life either by crying or in any other mode, and after death there was no air in the lungs. As in cases of infanticide, if the evidence of live birth rests entirely on an examination after death, the absence of air from the lungs will not necessarily show that a child has come into the world dead, nor will the presence of air in these organs prove that it has been born alive, because it may have breathed and died before birth. The child must be heard to cry, or be seen to breathe or move, after birth. The fact that the lungs are not distended with air, and that they immediately sink in water, either when entire or when divided into small pieces, is no proof that a child has not breathed and cried during birth and afterwards. (See cases by Dr. Vernon, and Dr. Davies. INFANTICIDE.) Although in Dr. Vernon's case the child had only reached the sixth month, it was strong enough to cry; and yet probably, had its history been unknown, a medical witness would have been prepared to swear, from an examination of the lungs, that it must have been born dead, and certainly could not have had the power of uttering a cry! A child born at the fifth month has been known to cry (see LEGITIMACY, p. 820); but the state of its lungs is not recorded. In the case of *Gardiner* v. *Llewellyn*, a medical witness who appeared for the plaintiff stated as his belief that a child born at the fifth month could *not respire*, and if it could not breathe (so as to fill the lungs) it could not cry! This may have been consistent with his experience, but it is not consistent with facts observed by others. One of the greatest difficulties that lawyers have to contend with in getting at medical truth, is in this strong disposition on the part of witnesses to act upon a foregone conclusion, and to 'fix' all natural events by an exclusive reference to their individual experience.

2. The child must be *born* while the *mother* is *living*. From this it appears that if a living child were removed from the outlet after the death of the mother, or extracted from the uterus by the Cæsarean operation, the husband would not become entitled to enjoy his wife's estate; although the child might survive its removal or extraction, and succeed to the estate on attaining its majority. How such a case would be decided in the present day it is difficult to determine; but one instance is quoted by most medico-legal writers from Lord Coke, in which, about three centuries since, the decision went against the husband, in consequence of the child having been removed from the uterus by the Cæsarean section *after* the death of the wife. (For a singular case involving this question in France, see 'Ann. d'Hyg.,' 1838, vol. 1, p. 98.) In the case of Llewellyn (*suprà*) the late Baron Alderson ruled that the husband could not take the estate unless the child was proved to have been born during the marriage.

Cæsarean extraction.—The Cæsarean operation has rarely been performed in England, except when a female was actually dying or dead. Dr. Goodman, of Manchester, has collected and published, from the table of Dr. Merriman and other sources, an account of thirty-eight of these operations performed in this country since 1737. It appears that out of this number only three mothers have recovered, the children, with one exception in the three cases, having died. In eighteen cases the children were extracted living. ('Obstetric Record,' No. 4, 1848, p. 3.) Dr. Goodman himself performed this operation successfully on a female in November 1845. This child was extracted alive, and the woman perfectly recovered from the operation. ('Med. Gaz.,' vol. 36, p. 1392.) The husband or representative of the deceased parturient woman may object to the performance of this operation, even although the child may be living in the womb, and there may be a reasonable hope by an immediate operation of extracting it living. The late Dr. Lever informed me that on two occasions, in 1858, the husbands thus refused to allow him to operate on the dead body of the wife. I apprehend that no medical man would proceed to operate by force, or against the will of the husband: at the same time, in refusing his permission, the husband is not guilty of any legal offence. The practice on the Continent has been to undertake it while the woman was living, and the result has shown that it may thus be performed successfully both with regard to mother and child. (See 'Med. Gaz.,' vol. 19, pp. 822, 878; Cormack's 'Monthly Journal,' July 1845, pp. 541–543.) For a case in which this operation was successfully performed three times on the same person, see 'Brit. and For. Med. Rev.,' July 1836, p. 270. Important legal consequences may hereafter ensue from a more general adoption of this practice in England in respect to deformed females. Thus, supposing in any case a child were removed alive while the mother was living, both of them dying shortly afterwards,—Would the husband become a tenant by the courtesy? The law says the child must be *born*: and some lawyers would find ground for arguing whether extraction by the Cæsarean operation should be regarded as 'legal birth.' 'Illud autem valdè controversum est inter jurisconsultos, an is qui editus est, exsecto matris ventre, reputetur partus naturalis et legitimus et successionis capax.' (Caranza.) According to Fonblanque, the question is settled in the affirmative—a child extracted is a child born. ('Med. Jur.,' vol. 1, p. 236.) Our ancient law-authorities do not appear to have contemplated that the operation would ever be undertaken on a living female. The words of Lord Coke, which are considered to express the state of English law, are:—'If a woman seised of lands in fee taketh husband, and by him is bigge with childe, and in her travell dyeth, and the child is ripped out of her body alive, yet shall he not be tenant by the curtesie, because the child was not born during the marriage, *nor in the life of the wife*, but in the meantime her land descended.' According to Mr. Hobler, the Cæsarean operation does not divert the course of descent, or divest the husband of the life-estate, provided the child be born alive, and the mother was living when the child was born. ('Obstetric Record,' vol. 3, p. 66.) *Birth*, and extraction by the Cæsarean operation, are, therefore, treated by him as similar conditions.

As a proof that this operation is not always necessary, even when circumstances may appear to call for it, the following case, mentioned by the late Sir B. Brodie as having occurred in a French hospital, is of some interest. It is that of a woman whose pelvis was considered to be too narrow for the egress of the child. As she was at the full term of gestation, the Cæsarean section was proposed; but before the operators were ready to commence, the child was expelled by the natural efforts of the uterus, or, as Sir Benjamin expressed it, the child preferred coming into the world by the old road!' ('Lancet,' Dec. 1853.) This, however, is not the only case of the kind on record. There is great reason to believe that continental practitioners are too officious in suggesting the performance of this operation, and that it is often undertaken to the serious risk of the life of a female, when the case, if left to nature, would have done well. A case is reported to have occurred in Scotland in 1847, in which the Cæsarean operation was considered by several practitioners of experience to be the only means by which delivery could be accomplished. For-unately for the female, the labour was somewhat rapid, and she was delivered of a dead child, weighing about three pounds, before the arrival of those who had considered that the operation would be required. (Ed. 'Monthly Journ.,' July 1847, p. 30.) The fact is, on these occasions nature often adapts means o ends in a most unexpected manner. A case of the performance of this operation on a living female has been reported by Mr. Skey. Here sufficient time was allowed for the advancement of the labour, and it was evident to all hat delivery could not take place by the outlet; that embryotomy could not be performed; and that, unless the operation was resorted to, the female would nfallibly sink from exhaustion. The child was extracted, but the mother died n about thirty-six hours. ('Med. Gaz.,' vol. 39, p. 212.)

Medical jurists have differed respecting the period of gestation at which the peration should be performed. This would of course depend on the earliest eriod at which a child might be born capable of living. In reference to enancy by courtesy, a child might be extracted alive as early as the fifth month, but it would not be likely to survive unless it was at or about the eventh month. Some have alleged, that unless performed *immediately* after he death of the mother, the child would not be extracted living. The condition of the fœtus in utero is, however, peculiar, and quite distinct from that f a child living by the act of respiration. It is possible, therefore, that there may be a limited survivorship, and that the operation may be performed so te as an hour after the death of the mother with the possibility of extracting a living child. There are incredible accounts of children having been extracted living, many hours after the death of the mother. Dr. Kergaradec states that this happened in the case of the Princess Pauline of Schwartzenburg, who, while pregnant, was burnt to death at a ball given on the occasion of the marriage of the Empress Maria Louisa in 1810. The body was not examined until the following day, and the fœtus is stated to have been then found living! ('Ann. d'Hyg.,' 1846, vol. 1, p. 454.) The reader will find a full account of the medico-legal applications of this subject by Dr. N. Berg in Casper's 'Vierteljahrschrift' for October 1863, p. 219.

Birth after the death of the woman.—That a child may be born after the death of the woman, and survive its birth, is proved by the following case. A woman died during labour. The accoucheur who was summoned found the head of the child presenting, but too high up in the pelvis to allow of the application of the forceps to aid delivery. He immediately introduced his hand into the uterus, and a quarter of an hour after the death of the mother, and twenty hours after the rupture of the membranes, he extracted a male infant in a state of apparent death. The child, which was well-formed, was speedily resuscitated by the application of the ordinary means. ('Berlin Medicin. Zeit.' July 1836.) Had this case occurred in England, it would probably have been decided, according to the old precedent, that the husband could not become a tenant by courtesy, because by the death of the mother the marriage was dissolved and the land had descended before the child was born! Another case of the birth of a living child after the death of the woman will be found recorded in the 'Medical Gazette' vol. 46, p. 713; and a third, in which a dead child with the placenta was expelled from the uterus many hours after death, is reported in Casper's 'Vierteljahrschrift,' 1861, vol. 1, p. 186: see also 'Guy's Hospital Reports' (October 1864), for a remarkable case of post-mortem delivery as an effect of decomposition.

3. The child must be born capable of inheriting; therefore, if it be a *monster* which cannot inherit, the husband does not acquire a right of tenancy. There are some other legal conditions which must also be fulfilled, but I have here confined my remarks to that which may become matter for medical evidence.

Admitting that there are legal proceedings by which the obnoxious parts of this ancient custom may be set aside during the life of the wife, it is hardly just that the knowledge of the necessity for these precautions should be left to be acquired by accident. It would be better to abolish tenancy-by-courtesy altogether than to allow the succession of a husband to his wife's estate to rest upon a casualty of this kind.

Minority and majority.—The word *minor* is synonymous with that of *infant*; and is applied in law to anyone under the age of twenty-one years. The age of a person may render him incompetent to the performance of civil duties. Minors are frequently called upon to act as witnesses in civil and criminal cases. In rapes committed upon children it is especially important to notice whether the prosecutrix is or is not competent to give evidence. The law has fixed no age for *testimonial* competency, and I have never heard of the question being referred to a medical practitioner. The child is always orally examined by the Court, and it is soon rendered apparent by the answers whether the witness possesses a proper knowledge of the nature and obligations of an oath. If not, his or her testimony is not received, or, in a case of rape, the trial is postponed, and the child is placed under instruction, to appear again at the following sessions or assizes. The competency of a child as a witness, therefore, does not depend on age, but upon its degree of understanding. In respect to criminal responsibility as affected by age, it was held by Keating, J., in a recent case (*Reg.* v. *Cowley*, 1860), in which the prisoner, a boy aged *eight* years, was charged with felony, that up to seven years of age the law presumed that a child could not distinguish right from wrong, so as to be capable of crime; and evidence was not admissible to prove that he possessed that capacity. But after the age of seven, and up to fourteen years, though the law presumed a child to be *primâ facie* incapable of crime, this presumption might be rebutted by evidence which showed that he had what was called a mischievous discretion. In the present case there was no evidence of that sort, and therefore his lordship directed the jury to acquit the prisoner. In another case, tried before the same learned judge in May 1863 (*Whitby* v. *Hodgson*), —an action for trespass and false imprisonment was brought against a man for giving into custody, on a charge of stealing, a boy under six years of age. It appeared that the child had stolen some wood; but it was held that at this age, and under seven years, a child was *doli incapax*,—hence that the defendant was not justified in giving the boy into custody. The jury returned a verdict with damages against the defendant.

According to the principles of our law, a male at fourteen is considered to be at years of discretion, and becomes then responsible for his actions; at twenty-one he attains majority, and is at his own disposal, and may alienate his lands, goods, and chattels by deed or will. It is only when this age has been attained that an individual can be sworn to serve on a jury. The period at which a male is considered to have attained full age varies in different countries: thus, in the kingdom of Naples it was formerly fixed at eighteen years; in Holland at twenty-five; but generally throughout the States of Europe the law prescribes twenty-one years, the same as the common-law of England.

A child under fourteen indicted for murder must be proved to be conscious of the nature of the act. In the case of *Reg.* v. *Vamplew* (Lincoln Summer Assizes, 1862), in which I was required to give evidence, a girl under fourteen years of age was convicted of destroying the life of a child by strychnia. It was shown that she was competent to understand the nature of the act. Under fourteen a male infant is presumed to be incapable, on the ground of incapacity, of committing a rape as a principal in the first degree, or even of committing an assault with intent to perpetrate that crime; but if the boy have a mischievous discretion, he may be convicted as a principal in the second degree. The patient may be convicted of an unnatural crime, although the agent be under fourteen. A female under the age of ten years is presumed to be incapable of consenting to sexual intercourse. ('Taylor on Evidence,' vol. 1, p. 117.)

A person is completely of age the first instant of *the day before* the twenty-first anniversary of his birthday, although forty-seven hours and fifty-nine minutes short of the complete number of days counting by hours; and this mode of calculating age and time is applicable to all the other ages before and after twenty-one. This is on the principle that a part of a day is equal to the whole of a day in a legal point of view. The following case in reference to this question was decided by appeal in the House of Lords, in February 1775. An estate was bequeathed to a Thomas Sansom so soon as he should arrive at the age of twenty-one. He was born between the hours of five and six on the morning of the 16th August 1725, and died about eleven in the forenoon on the 15th August 1746. The question was whether at the time of his death, he had arrived at full age. In the Court of Chancery it had been so decided, but it was urged that more than sixteen hours were wanting to complete the full term. This plea was overruled by their Lordships, and the decree confirmed, because the deceased was living on the day which would have completed the period. A few minutes or hours may thus determine the attainment of majority, and with this the responsibility of minors for civil contracts or the validity of their wills. By 1 Vict. c. 26, no will made by any person under the age of twenty-one years shall be valid; and as the day of a person's birth is included in the computation of his age, and there being in law no fraction of a day, a valid will may be made at any time on the day before that which is usually considered the twenty-first anniversary of birth.

There is another aspect in which this question of age may be viewed—namely, in reference to the responsibility of accused persons for alleged criminal acts. This will be apparent from the case of *Reg.* v. *Thornhill* (Stafford Lent Assizes, 1865). The prisoner was indicted for a misdemeanor in carnally knowing and abusing one Mary Sambrook, being a girl above the age of 10 and under the age of 12 years. It appeared in evidence that the girl's birthday was on the 5th of December 1852, and the offence was alleged to have been committed on the 4th of December 1864. The question then arose whether the girl was under the age of 12 years, so as to bring the offence within the statute. It was objected by the prisoner's counsel, that as on the 5th of December the girl would enter on her 13th year, she had therefore completed her 12th year on the 4th of December, and that the law did not recognise a fraction of a day in such a case, so that she was 12 years old as much on the first hour of that day as on the last—and his lordship (Pigott, B.) so held. The indictment contained counts alleging rape and assault, but, after the cross-examination of the girl, his lordship stopped the case, and the prisoner was acquitted. It is obvious that this principle would equally apply to charges of felony for the carnal knowledge of children under 10 years of age, as well as to the misdemeanor of taking girls under the age of 16 years from the custody of their parents or stealing children under the age of 14 years from their parents or guardians. (24 & 25 Vict. c. 100, ss. 50, 51, 55, 56.)

Plural births.—This has been regarded as a subject appertaining to medical jurisprudence; but I am not aware that there is any case on record in which the evidence of a medical man has been required respecting it. It is a simple question of primogeniture, which has been generally settled by the aid of depositions or declarations of old relations or servants present at the birth. Of course in the absence of eyewitnesses the question of priority of birth must be a matter of conjecture. It cannot be determined by the size of the child. Women may have two, three, four, or five children at a birth. Twins are comparatively frequent, but triplets and quadruplets are very rare. A case of triplets is reported in the 'Lancet' for October 1853, p. 316. According to Dr. Rüttel, out of 574,293 births in the kingdom of Prussia in 1840, there were 6,381 cases of twins, 72 of triplets, and 1 of quadruplets. This writer knew an instance in which a woman had *six* children at a birth. (Henke, 'Zeitsch.' 1844, p. 226; and 'Med. Gaz.' vol. 36, p. 607.) Mr. Guthrie states that in the Museum of the Royal College of Surgeons 'there is a large bottle containing five young ladies and gentlemen, all brought forth at one birth, and destroyed by an accident;' and he also says that he was for many years acquainted with a gentleman whose mother produced twenty-eight living children in the first twelve years of her married life. ('Lancet,' February 15, 1851, p. 176.) Mr. Russell met with a case, in 1849, in which there were five children at a birth. They were all males, and all born dead. The largest was six inches and the smallest was five inches long. They were prematurely born. There was one placenta of the ordinary size, with five umbilical cords attached to it round its centre. ('Lancet,' February 3, 1849.) Mr. Young states that he attended a woman who was delivered of four male children at one birth, three being from seven to eight months: they survived to the following day. One of the four was a fœtus of from fifty to sixty days, apparently showing conception at different periods. There was a placenta with four navel-strings quite distinct. ('Lancet,' March 1, 1856, p. 234.) Mr. Black, of Anstruther, has reported the case of a woman who was delivered on the 30th of June 1845, of four children, two males and two females. Three of the children weighed nearly four-and-a-half pounds each. They were alive and thriving on the 12th February following. ('Northern

Journal of Medicine,' March 1845, p. 265.) The only circumstance with respect to these plural births which it has been recommended that an accoucheur should attend to, is the order of their occurrence. The first-born child, according to an ancient principle of the common-law of this country, succeeds to the inheritance. In cases of twin or triplet males, a practitioner would find himself much embarrassed to express an opinion as to which was first born after the lapse of a certain period, unless there was some personal peculiarity or deformity which would at once enable him to stamp the identity of a child.

There is one case in which the law has interfered to prevent the inheritance of offspring, and this is in relation to monstrous births.

MONSTERS.

The connection of teratology or monstrosity with medical jurisprudence has been most ably investigated by M. St. Hilaire. Although legal questions connected with monstrous births do not often occur, yet it is proper that a medical witness should be acquainted with certain facts respecting them. The law of England has given no precise definition of what is intended by a *monster*. According to Lord Coke, it is a being 'which hath not the shape of mankind; such a being cannot be heir to or inherit land, although brought forth within marriage.' A mere deformity in any part of the body, such as supernumerary fingers or toes, twisted or deformed limbs, will not constitute a monster in law, so far as the succession to property is considered, provided the being still have '*human shape*.' Even a supernumerary leg would not probably be allowed to avert an inheritance! A trisceles monster, in which the third leg was a fusion of two legs, was exhibited in London in 1846. (See 'Med. Gaz.' vol. 37, p. 619.) From Lord Coke's description it is obvious that the law will be guided in its decision by the description of the monstrous birth given by a medical witness. It would not rest with a witness to say whether the being was or was not a monster—the Court would draw its inference from the description given by him. Various classifications of monsters have been made, but these are of no assistance whatever to a medical jurist, because each case must be decided by the peculiarities attending it; and his duty will not be to state the class and order of the monster, but simply in what respect it differs from a normal human being. In consequence of the want of a sufficient number of precedents on this subject, it is difficult to say what degree of monstrosity would be required in law in order to cut off the civil rights of a being. Monsters may be acephalous (headless), dicephalous (two heads with one body), or disomatous (two bodies with one head). Others again, like the Siamese twins, have two distinct bodies united by a broad band of skin. Would an acephalous monster be considered as devoid of human shape? Would a disomatous monster be allowed to inherit as one?—to marry as one?—or how would legal punishment be inflicted in the event of one of the bodies infringing the laws? Such are the singular questions which have been propounded by medical casuists in relation to these beings; and there is obviously ample room for the exercise of much legal ingenuity in respect to these questions. According to St.-Hilaire, the rule which has been followed in all countries respecting these monstrosities is to consider every monster, with two equally developed heads, whether it be disomatous or not, as two beings; and every monster with a single head, under the same circumstance, as a single being. He ascribes the origin of this rule to the performance of the rite of baptism in all Christian countries upon each head, when the monster is dicephalous. This view appears rational when we consider that with two heads there are two moral individualities;

while with a single head, there is one will and one moral individuality. But it is doubtful how far this doctrine would be accepted by jurists and legislators. The question whether, in a dicephalo-disomatous monster, the two beings should be bound by the act of one, either in civil or criminal jurisprudence, is a matter which, if these monstrosities were more frequent, would give rise to serious difficulties. Such a question is not purely speculative, because it might easily have been raised in respect to the Siamese twins during their stay in this country; and, according to St.-Hilaire, a case of this kind was actually decided in Paris in the seventeenth century, in relation to a double-headed monster. The author relates that this double monster killed a man by stabbing him with a knife. The being was condemned to death, but was not executed on account of the innocence of one of its component halves! ('Ann. d'Hyg.' 1837, vol. 1, p. 331.) According to the same authority, compound monstrosity is not transmissible by generation. The reader will find an account of the most remarkable monsters born during the present century in a paper by Dr. Rüttel (Henke, 'Zeitschrift der S. A.' 1844, p. 229.) Among them is mentioned a tricephalous (or three-headed) monster, born living in Paris in 1830. Each head was baptised under a separate name. Monsters, especially the dicephalous or two-headed variety, are either born dead or die soon after birth, yet within a recent period two have been known to live; the one, Christina Ritta, for nine months,—the other, the Siamese twins, may be still living.

Christina Ritta was born in Sardinia in 1829. This monster was double from the head to the pelvis; the two vertebral columns being distinct as far as the os coccygis. The left bust was christened by the name of Christina, the right by that of Ritta. The monster was brought to Paris, where it died about *nine months* after its birth. An excellent model of it may be seen in the Museum of Guy's Hospital, together with some good specimens of the dicephalous and disomatous varieties. In the further description of it, it may be observed, that below the pelvis the monster is single. There are two heads, resting on two necks; and the union or fusion of the two busts is effected laterally towards the middle portion of the chest, so that the two corresponding breasts are almost blended. The abdomen, as well as the pelvis, evidently formed by the junction of two primitive pelves, is single. In the chest there were found two distinct sets of lungs and two hearts; but these were inclosed in a single membrane (pericardium). During life the pulsations of these organs were so uniform that there was considered to be a single heart. There was only one diaphragm,—a fact which accounted for the simultaneous death of both bodies; one only having been previously indisposed.

The *Siamese Twins*, born in 1811, may be regarded as forming the most remarkable duplex monster of modern times. Many professional men must have had an opportunity of seeing them when exhibited in London in 1830. There was such a resemblance in their features that it was impossible to distinguish them except by remembering their position as to the right or left hand: they had distinct volitions, and could converse at the same time on different subjects with different persons; their movements were simultaneous, so as to appear like those of a single being. In short, they could be regarded in no other light than as two distinct beings united at the abdomens by a narrow fleshy band: this band of union was, however, so intimate as to render it probable that they had only one peritoneal cavity between them. When either coughed, the band swelled up in its whole length; this formed an insurmountable obstacle to their separation. It would, however, have been impossible, in relation to civil and criminal jurisprudence, to have made both responsible for the acts of one, since they occasionally differed in opinion!

Dr. Fifield, of Weymouth, Massachusetts, informed me that in July 1853, the Siamese twins were residing on a large plantation which they possessed in Chester County, North Carolina: they had then attained the mature age of 42. Some medico-legal difficulties of a civil nature had been solved by their entering into the matrimonial state. They were married to two sisters, and therefore had entered into the contract as separate beings; but no charge of bigamy had arisen out of this double union. It is probable also, although I have no information on this point, that they enjoy the rights of citizenship as two independent beings. It is clear, from this independence of will and action, that one might kill a person under circumstances which would constitute murder or manslaughter, the other not being an assenting party, and endeavouring to prevent the perpetration of the crime. The application of the criminal law would, as in the Parisian case related by St.-Hilaire, become a subject of great difficulty. No punishment could be inflicted on the guilty without necessarily involving the innocent (undivided) moiety. Such a case of monstrosity is quite *sui generis*, and must be regarded as setting at defiance all the ordinary rules of law, whether civil, criminal, or canonical.

For an account of a case of a monocephalic disomatous monster which was born alive, but died soon after birth, see 'Edinburgh Medical Journal' (vol. 55, p. 76); and at page 435 of the same volume is an account of a dicephalous monster born at Manchester in 1840.

Malpositions, transpositions, or defects of the internal organs of any of the cavities do not form monstrous births within the meaning of the English law. The legal question relates only to *external* shape, not to *internal* conformation. It is well known that many internally malformed persons live to a great age; and it is not until after death that malpositions and defects of this kind are discovered. In French jurisprudence the case appears to be different; if the malposition or defect was such as to become a cause of death soon after birth, the child would be pronounced not '*viable*,' and therefore incapable of acquiring civil rights. Some medical jurists have discussed the question of '*viability*' in new-born children, *i.e.* their healthy organization, with a capacity to continue to live, as if it were part of the jurisprudence of this country; but I am not aware of any facts which bear out this view. The English law does not regard *internal* monstrosity as forming a bar to civil rights; and the cases of *Fish* v. *Palmer*, of *Brock* v. *Kellock* (1861), and of *Llewellyn* v. *Gardiner* (*ante*, pp. 797, 798), show clearly that the simple question in English jurisprudence is, not whether a child is or is not '*viable*,' but whether it has manifested any distinct sign of life after it was entirely born. The French law is much more complex, and throws a much greater degree of responsibility on French medical jurists. (See *Viability*, p. 818.) It is proper to state that no person is justified in destroying a monster at birth.

LEGITIMACY.

CHAPTER 63.

LEGAL PRESUMPTION OF LEGITIMACY—DATE OF CONCEPTION NOT REGARDED—DIFFERENCE BETWEEN THE ENGLISH AND SCOTCH LAW—CHILDREN BORN AFTER DEATH—NATURAL PERIOD OF GESTATION—DURATION FROM ONE INTERCOURSE—PREMATURE BIRTHS—SHORT PERIODS OF GESTATION—VIABILITY—EARLIEST PERIOD AT WHICH A CHILD MAY BE BORN LIVING—'FAMA CLAMOSA'—EVIDENCE FROM THE STATE OF THE OFFSPRING—CAN FULLY-DEVELOPED CHILDREN BE BORN PREMATURELY?—PROTRACTED BIRTHS—LONG PERIODS OF GESTATION—LONGEST PERIODS YET KNOWN—PERIOD NOT FIXED BY LAW—EVIDENCE FROM THE STATE OF THE CHILD.

Legal presumption of legitimacy.—Every child born either in lawful matrimony, or within a period after the death of the husband in accordance with the natural duration of gestation, is considered by the English law to be the child of the husband, unless the contrary be made clearly to appear by medical or moral evidence, or by both combined. It is only in reference to *medical* evidence that the subject of Legitimacy can here be considered; but it is extremely rare to find a case of this kind determined by medical evidence alone. There are generally circumstances which show that a child whose legitimacy is disputed is the offspring of adultery, while the *medical* facts may be perfectly reconcilable with the supposition that the claimant is the child of the husband. These cases, therefore, have been repeatedly decided from *moral* evidence alone—the medical evidence respecting the period of gestation or physical capacity in the parties leaving the matter in doubt. The law which formerly prevailed in this country was to the effect, that if a child were born during marriage, the husband being within the four seas of the realm (*intra quatuor maria*), and no physical impossibility being proved, the child was legitimate. Access was presumed unless he could prove that he was '*extra quatuor maria*' for above nine months previous to the birth. ('Blackstone,' vol. 1, p. 456.) But the present state of the English law on the subject appears to be this. A child born during marriage is deemed illegitimate when, by good medical or other evidence, it is proved that it was *impossible* for the husband to be the father—whether from his being under the age of puberty, from his labouring under physical incapacity as a result of age or natural infirmity, or from the length of time which may have elapsed since he could have had intercourse, whether by reason of absence or death. With proof of non-access or immorality on the part of the mother, so important on these occasions, a medical witness is not in the least concerned. In a case of voluntary separation of husband and wife, which the law does not recognize, the children born are the children of the husband, unless non-access can be clearly proved. In January 1849 a woman applied to a magistrate for a summons against a man, to show cause why he refused to contribute to support a child of which she declared him to be the father. It appeared that she parted voluntarily from her husband, and had lived three years with the adulterer, and during the last year this child was born. The magistrate declined granting the summons, as she had no claim upon the adulterer. There was opportunity of access on the part of the husband, and he alone was liable in law for the maintenance of the child. In a case before Kindersley, V.C., *Atchley* v. *Sprigg* (33 'Law

Journal,' Chan., p. 345), it was proved that husband and wife had lived together nine years without having a child, and that they then separated and did not live together again. Ten years after the separation, and while the wife was in the habit of committing adultery with another man, a child was born. This child was treated by the paramour as his own, was called by his surname, and was brought up by him. Its legitimacy was contested, and the Vice-Chancellor decided that, notwithstanding the possibility of access on the part of the husband, the child was illegitimate. It was held that there was convincing evidence of illegitimacy, although access was possible. Another case decided by this judge (*Plowes* v. *Bossey*, Feb. 1862) shows, that where there is nothing strongly to affect the character of the woman, a child will be held to be legitimate, although the opportunity of intercourse may have been of the slightest possible description.

In some instances, the law assumes without medical evidence that the offspring is illegitimate, as where the husband and wife have been legally divorced '*a vinculo matrimonii.*' When children are born where the divorce is '*a mensâ et thoro*,' they are presumed to be illegitimate until the contrary appear.

There is a peculiar difference in relation to legitimacy between the laws of England and Scotland. A child born of parents in Scotland before marriage, is rendered legitimate by their subsequent marriage. In England the offspring is illegitimate, whether the parents marry or not after its birth; and under the Poor Law Act (4 and 5 Will. IV.), if a man marry a single woman having a child or children living, of whom he is not the father, he is bound to maintain them as if they were his own, and born after marriage. At the same time the children are not legitimated by the marriage. In the case of *Birtwistle* v. *Vardell*, decided on appeal by the House of Lords in August 1840, it was held that a child thus legitimated by the law of Scotland could not be allowed to succeed to his father as heir to real estate in England. The Scotch rule appears to be more consistent with natural justice; since, according to the English practice, it is inflicting confiscation on the offspring for a fault in the parents, which they had done all in their power to amend. (See also the case of *Dalhousie* v. *M'Douall*, on appeal to the House of Lords, March 1840.) These suits are chiefly instituted in respect to the right of succession to property or claims for peerages; and medical evidence is then frequently required to clear up the case.

From what has been stated, it will be perceived that the English law does not regard the date of *conception*, which cannot be fixed, but the date of *birth*, which can be fixed. Medical evidence may relate—1st, to the actual length of the period of gestation: this may be in a given case so short or so long, as to render it impossible that the husband could be the father. 2ndly, there may be physical incapacity in the husband to procreate: he may be too old or too young—or he may labour under some physical defect rendering it impossible that he should be the father. 3rdly, there may be sterility or incapacity in the female, rendering it impossible that the child should be the offspring of a particular woman: in other words, the claimant may be a supposititious child. (See SUPPOSITITIOUS CHILDREN, p. 850.)

Children born after the death of the wife or husband.—It appears that a child born *after* the death of the mother, provided she has been lawfully married, is legitimate, although the marriage is dissolved by the death. This is not a mere hypothetical question. Two cases have already been quoted (*ante*, p. 804), in which living children were born after the death of the women; these facts are of especial interest in relation to tenancy by courtesy. Whether the birth takes place by the aid of art through the outlet, or by eventration, as in the Cæsarean section, the husband, if the wife be at the time dead, cannot legally claim the estate; but the child thus born out of marriage is legitimate, and if it live may, on attaining its majority, take the estate of which the mother was seised. (See *ante*, *Cæsarean extraction*, p. 802.) The fact that the English law disregards the time, place, or date of conception might therefore give rise to a singular question. A child may have been conceived before the marriage of the parents, and be brought into the world by the Cæsarean operation after the death of the mother: hence it would neither be *begotten* nor *born* in wedlock, and yet, according to the principles of the English law, it would be the legitimate offspring of the marriage.

It sometimes happens that a child is born after the death of the husband. Conception is assumed to have taken place during wedlock; and although the child is not born in wedlock, the presumption is in favour of legitimacy, unless non-access or physical incapacity be distinctly proved. The legal questions which may arise under such circumstances are elsewhere considered. (See POSTHUMOUS CHILDREN, p. 844.) Hence *conception* during wedlock, and *birth* after the dissolution of the marriage by death—or conception before wedlock and birth during that state—or conception and birth during lawful wedlock, equally create a presumption in favour of the legitimacy of offspring.

Natural period of gestation. Duration from one intercourse.—The first point to be considered is—What is the natural period of gestation, and whether this is fixed or variable. According to the testimony of experienced accoucheurs, the average duration of gestation in the human female is comprised between the *thirty-eighth and fortieth weeks* after conception. Numerous facts show that the greater number of children are naturally born between these two periods. Out of 186 cases reported by Dr. Murphy, the greater number of deliveries took place on the 285th day ('Obstetric Reports,' 1844); but his opinion is that 301 days may be taken as the average limit of gestation. ('Lancet,' Nov. 11, 1844, p. 284.) Dr. Blundell considered that the average period was 274 days; Dr. Simpson (*Bromwich* v. *Waters*, Chester Lent Assizes, 1863, p. 825) 277 days, *i.e.* nine calendar months and a week; and other accoucheurs of repute have fixed upon 280 days. Among 500 cases observed by the late Dr. Reid, there were 283 in which the period of gestation was within 280 days, and 217 cases in which it went beyond this period. Dr. Duncan found, in a group of forty-six cases, that 275 days is the average interval between that which he terms 'insemination' (intercourse) and parturition. The largest number of cases on any particular day was seven on the 274th day. ('Edin. Monthly Journal,' 1854, vol. 9, p. 230.) The most common cause of this variation in time is, that the usual mode of calculation, by reference to the suppression of the menstrual discharge, even in a healthy female, may lead to a possible error of two, three, or even four weeks, since there is no sign whereby, in the majority of women, the actual time of *conception* can be determined. Some females have been able to determine, by peculiar sensations, the time at which they have conceived; but, as a general rule, this must be a matter of pure conjecture when they are living in connubial intercourse.

On the other hand, accidental and isolated cases have clearly proved that a great difference naturally exists among women with respect to the period of gestation; and it is probable that in no two is it necessarily the same. When there has been only *one* intercourse, the duration of pregnancy may be certainly calculated without reference to any changes in the female constitution: for the date of conception, within certain limits to be presently mentioned, would be fixed. Observations of this kind have shown that women have differed from each other; and in several instances the time has exceeded or fallen short of the period of forty weeks, which has been usually set down as the limit of natural gestation. In three cases known to the late Dr. Rigby, labour came on in 260, 264, and 276 days, making a difference of sixteen days. ('Med. Times,' March 14, 1846, p. 471.) In three other instances, which were privately communicated to me by Dr. S. W. J. Merriman, labour commenced at 281, 283, and 286 days respectively after one intercourse; and in a case which occurred to Dr. Reid, the labour did not commence until after the lapse of 293 days from a single intercourse. ('Lancet,' July 20, 1850, p. 79.) In another case accurately observed, communicated to me in March 1865, the gestation lasted 281 days. Menstruation had ceased on the 16th Sept., intercourse took place on the 20th, quickening occurred on the 23rd January following, and a full-grown male child was born on the 28th June following. In two cases, for which I am indebted to the late Mr. Carrington, the females were delivered respectively in 249 and 260 days after a single intercourse. In a third, in which pregnancy was the result of a rape, there was an interval of 261 days between intercourse and delivery. Hence it will be perceived that in well-observed cases, where there could be no motive for misstatement, and in which the characters of the females, some of whom were married and had already borne children, were beyond the reach of suspicion, a difference of not less than *thirty-three days* has been observed to occur,—*i.e.* between the earliest case recorded by Dr. Rigby, and the latest reported by Dr. Reid. This is worthy of remark, because in a case referred to hereafter (*Luscombe* v. *Prettyjohn*, *post*, p. 837), it was held that 299 days, only six days longer than in Dr. Reid's case, was an *impossible* period for human gestation! In addition to the above facts, showing the variability of the period after a single intercourse, the following may be cited. Dr. Macilwain, U.S., has reported a case of gestation, which he thinks must have extended to 296 or at least to 293 days. ('Amer. Jour. Med. Sci.' July 1848.) I am indebted to my colleague, Dr. Oldham, for nine cases, which have fallen under his own observation, in which the duration of pregnancy from a single intercourse was accurately observed:—

Case.	Days.	Case.	Days.
1	266	5	280
2	268	6	281
3	271	7	283
4	280	8	284
		9	285

It is to be observed of these cases that Nos. 4, 5, and 6 represent the periods of gestation in the same woman at different times. Dr. Lockwood has published the following as the result of his experience. The actual duration of the term of gestation in the human subject, *i.e.* the interval between intercourse and delivery, was ascertained by him in four cases:—No. 1, aged 19, duration 272 days (first confinement); No. 2, aged 30 (first confinement), duration 276 days; No. 3, aged 17, duration 270 days; No. 4, aged 44 (seventh confinement), duration 284 days, the child weighing fourteen pounds. ('Brit. Amer. Jour.' Dec. 1847, p. 214.) M. Devilliers has also published the particulars of nine cases, in which the interval from a single intercourse was accurately determined. Delivery took place at the following periods:—229, 246, 257, 267, 301, 276–281, 278–283, 270, and 266–272 days, making an extreme difference of 49 days in the earliest and the latest periods between intercourse and delivery. ('Gaz. Méd.' Mars 4, 1848.)

Cause of the variations.—It appears probable, from recent researches, that the duration of the pregnant state may be dependent on the relative excitability of the uterine system at the menstrual periods. Numerous facts tend to show that, notwithstanding the general suppression of the menses, there is great excitement of the uterine system at what would have been, in the unimpregnated state, the regular menstrual periods. Sometimes, as it has been elsewhere stated, this really amounts to a periodical discharge of blood. There is also great reason to believe that abortion takes place more readily at these than at other periods. Hence some accoucheurs are inclined to consider that the duration of pregnancy is really a multiple of the menstrual period; and that in the majority of women it will occur at what would have been the tenth menstrual period, or forty weeks from the date of intercourse and supposed conception ('Gaz. Médicale,' 4 Décembre 1847, p. 968); and, according to the degree of excitement of the uterine system, the child may be expelled at a period earlier or a period later than that which is assigned as the more usual natural term. It is in some respects a confirmation of this view, that the menstrual function is again frequently established one month after parturition. Dr. Reid, however, states that the exceptions to this theory are so numerous as to destroy its value as a rule. He quotes two of these cases in support of his opinion. In the first case, impregnation took place one day before the expected catamenial period; the menstrual flux appeared at the usual time, but its duration and amount were greatly reduced: labour occurred 280 days after the day of conception.

In the second case, occurring in the same woman, conception took place on the fourth day after the cessation of the catamenia (which lasted seven days); yet labour, as before, happened on the 280th day from the time of conception—*i.e.*, eleven days later than the time for the eleventh recurrence of the menses, the usual interval being twenty-six days. ('Lancet,' September 9, 1853, p. 207.) Admitting that conception may occur at any time between two menstrual periods, this theory will explain the variations which have been noticed in the duration of pregnancy after one intercourse. The late Dr. Rigby held the opinion that parturition takes place at the fortieth week, because the development of the child then acts by distending the uterus, which, in its irritable state, tends to throw it off. It is not, however, found that the duration of pregnancy is at all dependent on the size and weight of the child, or that children born at the fortieth week resemble each other in these respects. Hence the commencement of parturition cannot be ascribed to the physical conformation of the child. It would be desirable to know whether this periodicity can be generally traced in the time at which labour commences. Some women menstruate every three weeks: and, so far as I can ascertain, it has not been shown that in them the correspondence of gestation to their menstrual periods has been made out. Such females should, according to the theory, bear children to the thirtieth period from the date of the last cessation. Dr. Clay believes, from the observations which he has made, that the variation in the period of gestation is dependent on the age of the female as well as of the male. He considers that the term of gestation is extended in proportion to the age of the female, and that while in a female of 17 the period may be taken at 270 days, in a woman of 44, it would extend to 284 days. Again, when a female has been impregnated by a male much older than herself, the term of utero-gestation is, in his opinion, longer than would be assigned to a female of this age, and *vice versâ.* ('Record of Obstetric Medicine,' June 1848, p. 212.)

It has been supposed that cases of lengthened gestation were nothing more than instances of protracted parturition: the pains indicative of delivery commencing at the usual time, but continuing more or less over a much longer period than usual. In an instance mentioned by Dr. Jörg, a woman went her full time, but the parturition lasted a fortnight longer, the symptoms appearing and then disappearing. Admitting that this occasionally happens, still it shows that gestation from a particular pregnancy may be protracted considerably beyond the ordinary period.

There is no reason to believe that the *sex of the child* has any direct influence on the length of the pregnancy. It has been stated that gestation was longer with male than female children; and evidence of this kind was actually tendered in the Gardner Peerage case. A medical witness then asserted that the average period was 280 days for a female, and 290 days for a male child. The Solicitor-General very properly inquired—Supposing the child is an hermaphrodite, what then is the time? The witness said that he would take between the two! It is not observed that children labouring under sexual deformity are born earlier or later than those in which the sexual organs are perfectly developed. As an answer to this singular hypothesis, it may be observed that of Dr. Murphy's two protracted cases (*post*, p. 831), the one was a female and the other a male child.

Date of conception.—Another and probable cause of the differences is that the date of conception is not the same after a single intercourse in different females. It is customary for physiologists to date conception from intercourse: but the researches of Bischoff and Raciborski have shown that a variable interval may elapse, according to the situation of the ovum at the time. Bischoff believes that the ovum escapes from the Graafian follicle just as the menstrual discharge is about to cease, and he is of opinion, that to be fecundated, it must be acted on while it is in the Fallopian tube. Hence he considers, in order that impregnation should take place, that there must have been an intercourse within eight or twelve days from the cessation of the menstrual discharge: and in answer to the objection, that there are some women who become pregnant at any period, he considers that there is great uncertainty in the time at which the ovum leaves the ovary,—at which it enters the Fallopian tube, and how long a period it may take to reach the uterus, but that, as a rule, impregnation ensues shortly after the cessation of menstruation. ('Med. Times and Gazette,' April 8, 1854, p. 351.) Raciborski considers that the time is more limited. Out of sixteen women who gave him such information as enabled him to determine the time of fecundation, there was only one in whom this occurred so late as ten days after the cessation of the menstrual flux; and in this one, the menses had been suddenly arrested several days before the usual time of cessation, so that the extrusion of the ovum did not probably take place until about two days prior to the act of intercourse to which it owed its fecundation. (Baly and Kirke's 'Recent Advances in Physiology,' 1848, p. 58.) These authors also state that Naegele is accustomed to reckon the duration of pregnancy at nine months and eight days from the last menstrual period, and in normal cases he has found this to be correct. Dr. Oldham met with a case in which impregnation took place twelve days after menstruation; and he states that he has known it to occur at the respective times of ten days, twelve days, and even twenty-one days after the monthly periods; and he knows of no fact to disprove the opinion that the human female is susceptible of impregnation at any time between her monthly periods. ('Med. Gaz.' vol. 44, p. 48.) In the same volume (at page 930) Mr. Kesteven has reviewed the theory of Bischoff at some length, and to his remarks I must refer the reader. According to Dr. Duncan, a single insemination at any period of the interval between two menstrual periods may result in fecundation. ('Edin. Monthly Journal,' 1854, vol. 9, p. 233.)

The experience of Dr. Oldham is confirmed by that of the late Dr. Reid. This gentleman admits that impregnation is more likely to occur immediately after the termination of a menstrual period than at any time during the interval. The next most likely period is immediately previous to the occurrence of menstruation, and the probability of conception becomes slighter as the time is more distant from this epoch. According to Raciborski, from observations made in Paris of one hundred women, no more than six or seven had become impregnated at the mid-term from the menstrual periods. In the opinion of Dr. Reid, if we are to be guided by the number of days which have elapsed between the last appearance of the menses and parturition (this, however, he shows to be a most fallacious guide), there is no period in the menstrual interval at which impregnation may not occur. ('Lancet,' Sept. 3, 1853, p. 206.) In cases of single intercourse, the dates being certain, conception took place twelve and fourteen days after menstruation; several of these cases occurred within Dr. Reid's own knowledge. It is here assumed, however, that conception is synchronous with intercourse. It may be therefore fairly taken as a fact, irrespective of any modern theories of ovulation, that a woman may conceive from intercourse had at the inter-menstrual period (mid-period), although, in a given number of instances, it is probable that the conceptions would be more numerous within six or seven days after the cessation of the menses than at any other time.

Some of Dr. Reid's observations show the fallacies which may arise by placing confidence in the cessation of the menses as a date for calculating the duration of pregnancy. The wife of a physician, whom he attended, had the last catamenial appearance on November 7, and was confined on August 21, (287 days); no intercourse, however, had taken place until November 18 (276 days). In another case, labour occurred 281 days after menstruation, but 277 days after the first intercourse. One case occurred to him which occasioned some amusement in the end to all parties concerned, owing to the lady having implicitly relied on the date of the catamenia as a guide, without taking into account another circumstance of still greater importance in the calculation. This patient, who had already borne a child, had her last menstrual appearance on July 8; she quickened, *she thought*, about November 7, and her confinement was expected about the 12th of April. The lady's mother travelled 400 miles, at a great inconvenience to her own domestic arrangements, in order to be present at the accouchement; and as day after day passed over without its occurrence, much uneasiness was felt by both parties, and Dr. Reid was sent for repeatedly to allay their fears, and explain the cause of this unexpected delay. The dates were all again carefully compared, and the 8th of July was fixed on as the proper catamenial point to start from. Dr. Reid could only suggest that impregnation had occurred at a later period of the interval than had been supposed; and at length, on putting the question if the lady's husband had been at home on the 9th of July, he found that he had not returned from an excursion into Scotland until the 23rd of that month. The explanation was now very easy, and the lady was safely confined on April 28. In this case 294 days had elapsed since menstruation, but 279 only from the earliest possible time of conception. ('Lancet,' Sept. 9, 1853, p. 207.)

Recent physiological researches have proved that the date of *conception* is not fixed by the date of *intercourse*. The time occupied by the descent of the ovum along the Fallopian tube varies, while the time required for the passage of the male fluid to meet the ovum is also subject to variation. The investigations of Bischoff and Valentin show that the spermatozoa may retain their movements, and probably their fecundating power, for so long a period as *seven days* within the body of a female. Fecundation cannot result unless the matured ovum meets these bodies in a living condition; and conception may be regarded, in the language of Dr. Meig's, as the fixation of a fecundated ovum upon the living surface of the mother. These facts will account for some of the variations which are observed in the duration of pregnancy from a single intercourse. Conception may take place either in a few hours, or, according to Valentin's observations, at so long a period as seven days, after intercourse. But they do not satisfactorily explain such extreme differences as were observed in the cases of Dr. Rigby and Dr. Reid (thirty-three days), or in those of M. Devilliers (forty-nine days)—*ante*, p. 813. We must therefore be prepared to admit, either that conception may in some cases be delayed for so long a period as from five to seven weeks after intercourse, or that there may be a difference of from five to seven weeks in the duration of pregnancy. Whatever may be the explanation adopted, it is obvious that, in a medico-legal view, the only conclusion at which we can arrive is, that the period of gestation in woman is *not*, as it was formerly supposed to be, a fixed and invariable term.

Great mistakes have arisen in the calculation of the period by the use of the word 'month'—some intending by this a *lunar* and others a *calendar* month. Nine lunar months would be equal to 252 days, while the average of nine calendar months would be 270 days—the latter period varying according to the particular months of the year over which the pregnancy might extend. To prevent mistakes, or that misunderstanding of evidence which has so frequently arisen, it would be advisable that medical witnesses should always express the period of gestation in weeks or days, concerning which there can be no misunderstanding: it would be also proper to adopt the plan of always commencing the calculation from the period of the last cessation of the menses, rather than from two weeks later. The latter rule is often followed, and this discrepancy is another cause of confusion.

Premature births. Short periods of gestation.—From the preceding remarks we may regard all births before the thirty-eighth week as premature, and all those which occur after the fortieth week as protracted cases; and one great point for a medical witness to determine is, whether the characters presented by a child correspond to those which it should present, supposing it to be legitimately born. When the birth is premature, this sort of corroborative evidence may be sometimes obtained; because, assuming that there has been no access between the parties before marriage, children born at the fifth or sixth month after marriage cannot, if the offspring of the husband, present the characters of those born at the full period. It is not so with protracted births, for children are not more developed in protracted cases than they are in those which occur at the usual period. This would lead to the inference that when a child has reached a certain stage of development it ceases to grow—a view which is borne out by the observations of Dr. Rüttel. (Henke's 'Zeitschrift,' 1844, p. 247.) This gentleman observed that the size of a child did not increase in proportion to the length of gestation. In protracted human and animal gestation the offspring is not remarkable for size and weight. In both cases robust mothers have had small children, and small mothers strong and sometimes unusually large children. Dr. Murphy states that he met with a fully-developed child which was born after a gestation of only 251 days. ('Lancet,' Nov. 30, 1844, p. 284.) For an account of the characters presented by children at different uterine ages, see INFANTICIDE.

In judging from marks of development on the body of a child, we must make full allowance for the exceptions to which they are liable. The nearer the supposed premature delivery approaches to the full period of gestation, the more difficult will be the formation of an opinion. Although the characters of a seven-months' child, as a general rule, are usually well-marked, and may be known by common observation, it is not possible to distinguish with absolute certainty a child born at the eighth from one born at the ninth month. Burns observes that gestation may be completed, and the child perfected to its natural size, a week or two sooner than the end of the ninth month; and other accoucheurs corroborate this view. (Dr. Murphy in 'Lancet,' Nov. 30, 1844, p. 284.) In a series of cases which occurred to M. Devilliers, the following were the weights of children born at the respective periods:—

229 days . .	4·60 pounds avor.	270 days . .	6·8 pounds avor.
246 „ . .	4·88 „	272 „ . .	7·3 „
257 „ . .	6·68 „	283 „ . .	6·0 „
267 „ . .	7·71 „		

Hence the weight of a child born in the fortieth week may be less than that of another born in the thirty-seventh week of gestation. The weight in the third case may be taken as the average weight of a mature child, and the delivery took place *three weeks* before the usual period. (See 'Gazette Médicale,' 4 Mars 1848, p. 168.) Thus, then, a child born at the eighth month may be the offspring of the husband—at the ninth month, of an adulterer; but medical facts could not enable a witness to draw any distinction. It is here that moral proofs are necessary; for without these the legitimacy of a child, in such a case, could not be successfully disputed. With respect to twin-children, the greatest differences are sometimes observed. In a case which occurred to Mr. West, the first child born weighed only a pound and a half; the second weighed more than three pounds, and both lived several hours. The uterine age must have been the same. In another premature twin-case which occurred to the same gentleman, one child weighed two pounds and a quarter, and the other two pounds and three-quarters. ('Med. Times,' Feb. 23, 1850, p. 147.)

The fact that a child has had the strength to survive its birth for a certain period has been supposed to furnish additional evidence of maturity; for it is well known that under a certain age children are not born living, or, if living, they speedily die. Therefore it has been argued, if a child born at the fifth or sixth month after the first cohabitation be born living, or survive, this should, *ipso facto*, be taken as a proof of its illegitimacy. The following remarks will, however, show that an argument of this kind is liable to be overstrained:—

Earliest period at which a child may be born living. Viability.—According to the English law, it is not necessary that a child, when born, should be capable of living, or *viable*, in order that it should take its civil rights. Thus it may be born at an early period of gestation:—it may be immature, and not likely to survive:—or, again, it may be born at the full period of gestation, but it may be obviously labouring under some defective organization, or some mortal disease, which must necessarily cause its death within a short time after its birth. Fortunately, these points are of no importance in relation to the right of inheritance: an English medical jurist has only to prove that there was some well-marked physiological sign of *life* after birth (p. 798),—whether the child were mature or immature, diseased or healthy, is a matter which does not at all enter into the investigation. In this respect our law appears to be more simple and just than that which prevails in France. By Art. 725 of the Code Napoléon, no child that is born alive can inherit, unless it is born, as the law terms it, *viable*. The meaning of this word is not defined by the law itself, and there are probably no two lawyers or physicians in that country who place upon it the same interpretation. The French law seems to intend (Devergie, vol. 1, p. 700; Briand, p. 173), by viability in a new-born child, that it should have breathed and be capable of living out of the womb of its mother and independently of her;—also, that it should be capable of living for a longer or shorter period after its birth. It would be difficult for any system of jurisprudence to lay down a more vague or incorrect principle than this; and medical witnesses may consider themselves fortunate that in this country they have not to take part in the litigation to which such a principle must necessarily give rise. The effect of the French law is this: a child may be born alive—it may breathe and cry, and survive its birth for a considerable time; yet upon arbitrary medical principles, founded upon the period of gestation at which it was born, on its length, its weight, the colour of its skin, the length of its hair, and the form of its nails, it may be pronounced not viable—*i. e.* not capable of inheriting and transmitting property! But then, again, the child may be externally pronounced viable, and live four or five days; yet, on inspecting the body after death, if disease of the lungs, brain, or any organ which had its origin previous to birth, be found, it will be pronounced the contrary, and the rights of property are thus made to rest upon the most trivial and unsettled conditions. The presumption is, however, in favour of the legal rights of the offspring, when it has been clearly proved that it lived after it was born. The viability of the child is presumed, and those who would then benefit by the allegation of non-maturity must prove it. (Briand, 'Man. Complet de Méd. Lég.,' 1846, p. 173.) There may be no disease about the child, yet, owing to its having come into the world prematurely, it may not survive its birth beyond a few days. It may breathe, cry, take nourishment, and manifest all the signs of active and vigorous life; but about the third or fourth day the voice becomes more plaintive, the features more pinched, and the child gradually sinks from want of power to maintain an active and independent existence. Hence it has been suggested that before the eighth day after birth, a medical man is scarcely in a position to pronounce a child born prematurely to be viable, or to have a capacity to live, like children born in a normal state. ('Critical Inquiry on Superfœtation,' by Dr. Bonnar, p. 14.)

It may at first sight appear to be inconsistent with justice, that a child which is born immature, or labouring under disease, owing to which it cannot long survive its birth, should possess the same rights of inheritance as one which is born mature and perfectly healthy; but this evil to society, if it be admitted as such, is of far less magnitude than the adoption of a system which must constantly lead to subtle casuistical distinctions, and thereby create error and confusion. So long as there is no well-defined line between a child which is considered capable of living and one which is not, gross injustice must necessarily be inflicted by any rule of law similar to that which is admitted in the Code of France. In a recent case an attempt was made to push the doctrine of non-viability to such a degree as actually to include cases of injury inflicted by instruments during delivery; so that by the awkwardness of an accoucheur in the use of the forceps, a well-formed healthy child might, by reason of its death soon after birth, be pronounced *non-viable.* M. Tardieu was consulted in a case of this kind, and by his medico-legal experience he was enabled to satisfy the parties concerned that the child was perfectly *viable* in a medical sense, and that its death had arisen not from any congenital disease or malformation, but from injuries inflicted by instruments which were necessary to aid delivery. ('Ann. d'Hyg.,' 1853, vol. 2, p. 193.)

The question to be considered is,—What is the *earliest period* at which a child can be born living, and with a capacity to live after its birth and attain maturity? It is now universally admitted, that children born at the seventh month of gestation are capable of living, although they are more delicate, and in general require greater care and attention to preserve them, than children born at the ninth month:—the chances are, however, very much against their surviving. It was the opinion of Dr. William Hunter, and it is one in which most modern authorities concur, that few children born *before seven calendar months* (or 210 days), are capable of living to manhood. They may be born alive at any period between the sixth and seventh months, or even, in some instances, earlier than the sixth: but this is rare, and, if born living, they commonly die soon after birth. There is one case on record, of a child having been born living so early as the *fourth month* of gestation ('Brit. and For. Med. Rev.' vol. 2, p. 236); and another, in which a female aborted at the fourth-and-a-half month of pregnancy. M. Maisonneuve saw the woman two hours after delivery: he then found the fœtus in its membranes, and, on laying these open, to his surprise it was still moving. He applied warmth, and partially succeeded in restoring it; for in a few minutes the respiratory movements were performed with regularity, but, in spite of the establishment of respiration, the child died about six hours after its birth. ('Journal de Médecine,' and 'Med. Gaz.' vol. 39, p. 97.) In two instances of abortion about the *fifth* month, Dr. Davies, of Hertford, noticed that the fœtus showed signs of life after its birth, by moving its limbs ('Med. Gaz.' vol. 40, p. 1022); and the following case, in which a child born at the *fifth* month survived upwards of twelve hours, occurred to Mr. Smythe. A female in her second pregnancy, and in the 147th day of gestation, had severe flooding with rupture of the membranes. Labour occurred on the following night, when a small but well-formed fœtus was expelled, giving no other indication of life than a feeble action of the heart, and a strong pulsation in the umbilical cord. It was resuscitated, and *cried* as strongly as a child born at the full period of pregnancy. It weighed less than two pounds, and measured exactly twelve inches. It swallowed some nourishment, but died about twelve hours after birth. The membranæ pupillares were entire,—the testicles had not descended,—the head was well covered with hair. The length and weight, as well as the presence of hair, indicated a fœtus between the sixth and seventh months; but, as it is asserted that the period of gestation is acurately given, this must be regarded as an extraordinary instance of premature development. There was clearly nothing in the organization of this child to have prevented its growing to the age of maturity—in other words, it was *viable*. ('Med. Chir. Rev.' July 1844, p. 266.) Another case is reported, in which a child born at five-and-a-half months survived its birth between three and four hours ('Med. Gaz.' vol. 19, p. 165); and on a trial for child-murder (*Reg.* v. *West*, Nottingham Lent Assizes, 1848), a midwife was indicted for causing the death of a child, by bringing about the premature delivery of the mother, when she was between the fifth and sixth months of pregnancy. The child in this instance lived five hours after its birth. Capuron mentions an instance in which a child was born at the sixth-and-a-half month of pregnancy, and at the time he reported the case it was two years old, and enjoyed excellent health. In another instance a child was born at the same period, and lived to the age of ten years. ('Méd. Lég. des Acc.' pp. 162, 208.) In a case which fell under my own knowledge, a child was born at the sixth-and-a-half month of gestation, and lived a fortnight. (See another case, 'Med. Gaz.' vol. 32, p. 623.) Capuron considers that a child born at the 180th day, or at the sixth month after conception, may be sufficiently mature to live; *i. e.*, that there would be no reason to presume it was illegitimate, merely because it survived its premature birth. On the other hand, if born before the sixth month, with sufficient maturity to live, this fact, although by no means a proof, affords, in his opinion, a strong presumption of its illegitimacy. Of eight cases of children born living (by abortion) at the sixth month, Mr. Whitehead states that seven perished within six hours after birth, and only one attained to the age of ten days. ('On Abortion,' p. 249.)

Dr. Rüttel, who has examined the subject with great care, states, as the result of his experience, that he attended a married woman, who was afterwards delivered of a living child in the *fifth month* of her pregnancy: the child survived its birth for twenty-four hours. He delivered another woman of twins, in the *sixth month* of her pregnancy: one was dead, and the other continued alive for three hours, its life being indicated only by the visible pulsation of the heart—there was no perceptible respiration. This fact corroborates the remarks made elsewhere, as to life without active respiration (see INFANTICIDE); it has also an immediate bearing on the proof of life in reference to tenancy by courtesy. (Cases of *Fish* v. *Palmer*, and *Brock* v.

Kellock, p. 798.) In another instance of the birth of male twins, at the *sixth month*, each weighed three pounds. Dr. Rüttel saw them a year after their birth, and they were then two healthy strong children. (Henke's 'Zeitschrift der S. A.' 1844, p. 241.) Dr. Barker, of Dumfries, met with a case, in which a female child was born at the 158th day of gestation, or twenty-two weeks and four days after intercourse. The size and weight of the child corresponded with the period at which it was born: it weighed one pound, and measured eleven inches. It had only rudimentary nails, and very little hair on the back of the head; the eyelids were closed, and remained closed until the second day; the nails were hardly visible; the skin was shrivelled. The child did not suck properly until after the lapse of a month, and she did not walk until she was nineteen months old. When born the child was wrapped up in a box, and placed before the fire. Three-and-a-half years afterwards this child was in a thriving state and healthy, but of small make; she weighed twenty-nine pounds and a half. ('Med. Times,' Sept. 1850, p. 259; also Oct. 12, p. 392.) Mr. Annan, surgeon, of Kinross, has recorded a case in which a child was born between the end of the sixth and the middle of the seventh month, and lived for a period of four months and eight days; it weighed a pound and a half when seven days old. ('Med. Times,' Sept. 9, 1848, p. 304.) In a case which occurred to Dr. Outrepont, of Bamberg (reported in Henke's 'Zeitschrift,' vol. 6), there was the strongest reason to believe that gestation could not have exceeded twenty-seven weeks. The child (a male) weighed, when born, one pound and a half, and measured thirteen-and-a-half inches. The skin was covered with down and much wrinkled—the limbs were small—the nails appeared like white folds of skin, and the testicles had not descended. It breathed as soon as it was born, and by great care its life was preserved. It is singular that its development was very slow until it had reached a period which would have corresponded to the forty-second week of gestation. Dr. Outrepont saw the child when he had attained the age of eleven years, and then he appeared to be of the size of a boy of eight years. The only remarkable point about the case is the length of time which the child lived. In a case quoted in the 'Lancet' (Aug. 23, 1851, p. 177), a child born at six months and ten days was thriving satisfactorily when four months old. (See also 'Med. Times,' Feb. 16, 1850, p. 129.) A gentleman of a well-known family in Scotland was undoubtedly born before the seventh month. When first born the child weighed three pounds. As a child he was not expected to live, but he grew up a small strong man, capable of great mental and bodily exertion: he died from natural causes at about the age of 42. His head throughout life was large in proportion to his size.

Hence it is established that children born at the seventh, and even at or about the sixth month, may be reared, and that the fact of their surviving for months or years cannot be taken as evidence of illegitimacy. In forming our judgment on these occasions, we are bound to look less at the period at which a child is born, than at the marks of development about the body. The case reported by Mr. Smythe is corroborative of this view (p. 820). Dr. Bonnar has recently published a tabulated view of 112 cases of premature births of living children,—the dates of gestation extending from the 120th to the 210th day. Among these cases 35 children died within the first twenty-four hours; 13 more before the completion of one week; 1 in six weeks; 4 in four months. The following lived, or were living at the date of the report:—1, seven-and-a-half months; 8, from one to two years; 1, three-and-a-half years; 5, from ten to fifteen years; 6 to adult age; 5 lived not stated how long. ('Critical Inquiry regarding Superfœtation,' 1865, p. 13.)

In October 1835 an investigation (*fama clamosa*)—known as the *Kinghorn case*—took place before one of the Presbyteries of Scotland, in reference to certain reports which had been circulated to the prejudice of a minister of the district. The marriage of this gentleman took place on the 3rd of March 1835, and his lady gave birth to a female child on the 24th of August following—*i. e.* 174 days, or nearly *six calendar months*, after the marriage—and the child continued to live until the 20th of March 1836. When born it was very weak, and, according to the evidence of the accoucheur and others who saw it, it was decidedly immature. The birth of a living child, together with the fact of its surviving for so long a period, led, however, to the report that there must have been intercourse between the parties previously to marriage: it was contended that the period was too short for the child to have been begotten in wedlock. Dr. Hamilton of Edinburgh, on being applied to by the Presbytery, said that his own experience was opposed to the probability of a child born at the sixth lunar month surviving (the time in this case was six lunar months and six days); but he referred to two cases, in which children born under similar circumstances had survived their births for a long period. In one the lady was delivered within five lunar months (twenty weeks) after the marriage, and Dr. Pitcairn and others gave it as their opinion that it had been begotten within wedlock: in the other, a woman gave birth to a child nineteen weeks after conception, and it lived a year and a half. Dr. Thatcher, who examined the child, in the case here reported, nineteen days after its birth, gave it as his opinion that it might have been begotten on or after the 3rd of March; and the circumstance of its having been reared, in the premature state in which it was born on the 24th of August following, was no objection to this opinion. He considered the complaint made against the minister groundless. The case went through several appeals, and was not finally decided until May 1839, when the libel was found *not proven*, and the defendant was absolved from censure. Many medical witnesses gave evidence on the occasion: the majority of them were strongly in favour of this having been a legitimate and premature birth. (See 'Record of Proceedings, &c.' Edinburgh, 1839; 'Med. Gaz.' vol. 17, p. 92; also 'Med.-Chir. Rev.' vol. 31, p. 424.) Although not connected with the medical part of the case, it should be observed that the character of the parties was free from all suspicion, that no concealment had been practised by them, and that no preparation had been made for the early birth of the child. There were, it is true, *unusual marks of development* about the child, considering the early period of its birth; yet these were not sufficient, any more than the fact of its surviving, to induce the belief that it had been begotten out of wedlock. One case has been already mentioned in which a child, born at a still earlier period, survived several hours, and others in which children born rather later lived for two and ten years. It would be in the highest degree unjust to impute illegitimacy to offspring, or a want of chastity to parents, merely from the fact of a six-months' child being born living and surviving its birth. There are, indeed, no justifiable medical grounds for adopting such an opinion,—a fact clearly brought out by a question put to Dr. Campbell, the chief medical witness in favour of the alleged antenuptial conception. In his examination-in-chief he admitted that he had himself seen the case of a six-months' child who had survived for *several days*. He was then required to say, whether he could assign any reason why, if after such a period of gestation it is possible to prolong life for *days*, it should not be possible to extend it to *months!* He could give no satisfactory reply. ('Record of Proceedings,' &c. p. 55, and *post*, p. 849.)

The great injury which may be done by speculative medical opinions, such as those given against the chastity of the parties concerned in these proceedings, will be apparent from the record of a case which occurred subsequently to Dr. Halpin, of Cavan, in 1845. A healthy woman, æt. 34, the mother of five children, was delivered in the *sixth month* of her pregnancy of a female child. It was rolled in flannel, and laid in a warm place; contrary to expectation, the child survived, sucked vigorously, and was healthy in every respect. The ossification of the bones of the head was very imperfect, and the sutures broad enough to admit of the middle finger being laid between them, while the fontanelles were of correspondingly large size. The weight of the child, on the fourth day after birth, was two pounds thirteen ounces, and on the thirty-fourth day three pounds seven ounces. The child was alive and well when last seen on the 4th of March, *i.e.* four months after birth: she then weighed eight pounds eight ounces. After this Dr. Halpin lost sight of her, as the mother left that part of the country. ('Dublin Quarterly Journal,' May 1846, p. 563; see also Dr. Barker's case, *ante*, p. 821.) If the facts of these cases be compared with those of the Kinghorn case, it will be seen that there were no just medical grounds for the allegation that in the latter the child had been begotten out of wedlock. In these two cases six-months' children were living and healthy after four months and three-and-a-half years, respectively: in the Kinghorn case, it was supposed that the child must have passed the sixth month of uterine life, because it had survived seven months! In Dr. Halpin's case the child, four days after birth, weighed two pounds thirteen ounces—a six-months' child rarely exceeding two pounds: in the Scotch case it was considered that it must have been much beyond the sixth month, because a fortnight after its birth it weighed three pounds! These cases should be borne in mind when much reliance is placed upon the appearance presented by children as positive evidence of the state of uterine life which they are supposed to have attained.

Evidence from the state of development.—The fact that a child born at nine months is small, and resembles in size and weight a seven or eight-months' child, cannot be taken as a proof of illegitimacy. It has been already stated, that children born at the full period vary considerably in size and weight; yet, although small, there are commonly about them the appearances of *development.* This is especially apparent in the features. If there be a general want of development in the body, and if certain fœtal peculiarities remain,—as, for example, the membranæ pupillares, or, in the male, the testes do not occupy the scrotum—these facts lead to a strong presumption that the child has not reached the full period. On the other hand, when a child is born with the full signs of maturity about it, at or under seven months from possible access of the husband, then there is a strong presumption that it is illegitimate. In the Scotch case above related, the child was more developed than such children commonly are at a similar period of uterine life, but the differences were slight. The great progressive stage of development is considered to be during the two last months of gestation—the changes which the fœtus undergoes are greater and more marked at this than at any other time. The general opinion is that an eight-months' child is not with any certainty to be distinguished from one born at the ninth month. If the body of a child is large and fully developed, it would in a general way be considered to have been born at the full period of gestation, and any opinion which had led to the supposition that it was a seven-months' child would be attributed to some mistake in the calculation. Dr. Beck states it as barely possible that a child born at seven months may *occasionally* be of such a size as to be considered mature, yet he qualifies this statement by the remark, that the assertion is most frequently made by those whose character is in danger of being destroyed. The important question is, however,—Has a really seven-months' child ever been born so developed as to be mistaken by an experienced person for one that was mature? He adduces no case of this kind in support of his opinion. There can be no doubt of the correctness of his statement, that a *mature* child;

born *before* seven full months after intercourse, ought to be considered illegitimate: but it would be difficult to maintain this position, consistently with the above admission, for a child may acquire premature development during the latter half of the sixth as well as at the seventh month.

The following case in reference to development (at seven months) has been communicated to me by one of my pupils: it is well calculated to show the characters of a seven-months' child, and to corroborate the views adopted by physiologists respecting the means of determining the period of uterine life which the fœtus may have reached:—Mrs. F. was married on the 7th April 1846, and was delivered by my informant of a male child at 7 o'clock on the evening of the 19th October following,—the period of gestation being equal to 195 days, or twenty-eight weeks. The infant cried strongly, and lived until 9 o'clock the following morning; the skin was of a deep pink or rose-colour, beautifully soft, and covered with a fine down. The membranæ pupillares were absent, and the pupils were well formed,—the nails were complete,—the testicles had *not* descended into the scrotum,—the length of the body was fifteen inches, and its weight two pounds eight ounces. Its weight, and the non-descent of the testicles, at once referred it to a uterine age of seven months. In addition to the other characters assigned to children born at the seventh month (see INFANTICIDE), it may be observed that children at this uterine age do not so readily take the breast as those which have reached the ninth month, and their power of sucking is much more feeble.

Several cases have recently occurred in the Divorce Court, before the Judge Ordinary, in which the power of a medical man to form an opinion of uterine age from the appearance of a child at birth between the *seventh* and *ninth* months has been seriously called in question. In *Stone* v. *Stone* and *Appleton* (1864) the evidence showed that the husband (the petitioner) went to India in August 1859—that he returned to England in May 1861, and joined his wife on the 18th May. The wife (the respondent) was delivered of a full-grown child on the 2nd January 1862, and the delivery at this date was assumed to be conclusive proof of adultery on her part. She was attended by a medical man, who deposed that in his opinion the child was full-grown, *i.e.* a nine-months' child. Another medical man, who saw the child two or three days after its birth, also considered it to be full-grown. In comparing the date of possible access of the husband with the date of birth, the period of gestation would be 229 days, or seven weeks and two days short of the average period. The medical question was,—Could this be the child of the husband? On the part of the respondent, it was alleged that the child was a seven-months' child prematurely born, and more than usually developed for its age; and evidence was given to show that in her previous deliveries the children had been prematurely born. The evidence of obstetric experts was also called to prove that any medical opinion based on the maturity or immaturity of the child was of no value. Dr. Tyler Smith and Dr. Samuel Richards were examined, in order to show that children of between seven and eight months were frequently the same in appearance and in size as children born at the full period of nine months, and that any opinion formed from the inspection of a child after its birth as to the date of its conception, was very fallacious. They stated that out of a number of cases an experienced surgeon would be able to say with tolerable certainty in the majority, whether a child was a seven or eight or nine-months' child, but he would probably be mistaken in several cases; and they stated their reasons for their opinions, and mentioned cases in support of them. They also said that illness, bodily weakness, and mental anxiety tended to produce premature delivery, and that a woman who had once been prematurely delivered had a tendency to premature delivery if she afterwards became pregnant. The jury returned a verdict for the petitioner, finding that the wife had been guilty of adultery: therefore that this was not the child of the husband, *i.e.* it was not a seven-months' child.

In another case (*Wool* v. *Wool*, March 1865) the adulterous intercourse was stated to have taken place in May 1864, and a child was born on the 1st January 1865, giving 246 days (or thirty-five weeks and one day) for gestation, *i.e.* about five weeks earlier than the average period. In this case Mr. Tubbs, of Upwell, made an accurate observation of the state of the child. It was 19½ inches long; its weight was six pounds; the hair was fine and long; the nails reached to the finger-ends; the testicles were in the scrotum; the features were well developed; the skin was reddish-coloured, but the muscles were not so firm as in mature children. This degree of development is such as is usually seen in children born at the full time, but at the same time it is not inconsistent with the period of gestation above-mentioned—namely, about eight calendar months: it therefore falls under the exceptional cases referred to at p. 818.

In *Bromwich* v. *Waters* (Chester Lent Assizes, 1862) the question incidentally arose upon an alleged gestation of 259 days. It was stated that intercourse took place upon the 9th November 1861, and a child was born on the 26th of July 1862—a period of 259 day, or thirty-seven weeks. The child had the appearance of a mature child. The counsel for defendant admitted that a child born at this period, *i.e.* three weeks before maturity, might be as large as one born at the ninth month, but he denied that it would be so perfectly developed in all its parts. This distinction is not generally admitted: and when the question was put to Dr. J. Y. Simpson of Edinburgh, who gave evidence at the trial in favour of the defendant, he said that full size was generally combined with full development; and he further stated that it was against all the laws of nature that children should be born full-grown even a fortnight before the usual term of gestation, which he fixed at nine calendar months and a week. According to this view, if impregnation took place on the 9th November 1861, the day of probable (?) delivery would be a week after the 9th of the following August, *i.e.* the 16th August. Hence, as the child was actually born in a *mature state* on the 26th July, this was three weeks before the usual term; and therefore impregnation from some other person had probably taken place three weeks earlier than the period assigned by the woman (Whalley). Dr. Simpson considered it to be as rare that a child should be born full-grown three weeks before the usual period, as that a man should attain one hundred years of age! ('Report of the Trial of *Bromwich* v. *Waters*,' 1863, p. 33.) There are not many medical witnesses, however, who would venture to affirm that in the last three weeks of gestation there are such changes in the body of the child as to render the slight difference in time always perceptible, or who would venture to bastardize a child or convict a woman of adultery because, when born at the 259th day after intercourse, the child had about it the usual appearances of maturity. This would be equal to affirming that variations in size might take place at the ninth but not at the eighth month of gestation. But facts are adverse to the theory. Dr. Rüttel, an experienced observer, has met with several instances in which women have been delivered two and even three weeks before the expiration of the ordinary term (280 days), and the children were as perfectly developed, to all appearances, as other children which had been born at the full period.

A case was tried in the Common Pleas, in 1846, in which I was consulted on the part of the defendant (*Hargrave* v. *Hargrave*). The plaintiff contended that he was the child of John Hargrave, deceased; the defendant, that he (the plaintiff) was the illegitimate offspring of the same mother, but not the son of John Hargrave. The evidence in support of the illegitimacy was, as usual, partly medical and partly moral. The husband and wife had been separated for a considerable time prior to the birth of this child, and he chiefly resided in

France. The wife resided in London, as it was alleged, in adulterous intercourse with another person. The plaintiff was born on the 18th November 1836; and it was argued, for the defendant, that there was no possibility of access on the part of the husband, except at periods which would fall far short of, or go much beyond, the limits of human gestation. Defendant alleged that the husband was absent from London from October 1835 to about the latter end of April or beginning of May 1836: hence, in order that the child should have been begotten by him, this must have been a case either of *thirteen-months'* or *seven-months'* gestation. The former supposition was out of the question: it became, therefore, necessary to ascertain whether this child when born was *mature*, or whether it bore about it the characters of a seven-months' child. On this important point there was no satisfactory medical evidence. The delivery had taken place ten years before,—the practitioner who had attended the female had no distinct recollection of the circumstances,—he could not even remember the sex; and the only fact to which he could depose was, that when the child was born he observed nothing particular in its appearance—it did not differ from other children; and, in answer to a question from Lord Chief Justice Tindal, he said that there was but little difference between a seven-months' child and a nine-months' child, and one might be mistaken for the other. No observation was made as to the descent of the testicles or other peculiarities; and, in short, it remained as a mere presumption whether, from the attention of the witness not having been particularly drawn to its condition, the child was not in fact mature.

Additional evidence was produced by the plaintiff at the trial to show that the husband had been in London at other periods than those alleged by the defendants. Thus it was stated, by some of the witnesses, that he was there in February 1836 (making the period thirty-nine weeks and three days), again on the 3rd March (making it 259 days or thirty-seven weeks), and again on the 3rd May (making it 198 days or twenty-eight weeks and two days). In his charge to the jury, the learned judge (Tindal, C. J.) threw out the latter period, and directed them if they believed the evidence, and that there had been possibility of access at either of the two former periods, to find for the plaintiff. According to the medical evidence, whether the time was seven, eight, or nine calendar months, it would make but little difference in the appearance of the child. A verdict was returned for the plaintiff, establishing his legitimacy: but there was so much doubt about the case that, in November 1846, Lord Langdale granted a new trial, making at the same time the following remarks:—'Cases of this kind are very difficult to determine, and, but for rules and presumptions of law, it would often be impossible to arrive at any satisfactory conclusion. A child born of a married woman is presumed by law to be legitimate, but this presumption may be removed by evidence. It is not enough, however, in order to rebut it, that suspicious circumstances should be shown; but it is necessary to show circumstances, such as impotency or absence, from which it would clearly appear that sexual intercourse could not have taken place. It is difficult to conclude against legitimacy, in the absence of this evidence, where some association has continued between the parties, so as to afford an opportunity for intercourse. If the husband and another person both had opportunities of intercourse, whatever might be the probabilities, no evidence could be admitted to show that the husband was not the father of the child. Evidence against legitimacy ought to be strong, distinct, satisfactory, and conclusive. In the present case it appears that the husband had, for some years previous to the birth of the plaintiff, usually resided in France, but that he was in the habit of coming to England from time to time, and that he had occasional interviews and communication with his wife; and whether they were of such a nature as to enable him to be the father of the plaintiff is the question. The plaintiff was born on the 18th November 1836, and the question is whether the husband had had an opportunity of intercourse with his wife in the early part of that year. There is evidence that he had been in England at particular times, viz. January, March, April, and May in that year, and it is clear that he was *intra quatuor maria*. Then the question is, whether, although he was in England, he could be supposed to have had intercourse with his wife. Two witnesses have said they saw a person go into Mrs. Hargrave's house in the latter part of 1835, or beginning of 1836, and in February 1836, and that she had afterwards said that that person was her husband. In March 1836 Mr. Hargrave was at the Ship Tavern, and informed the waiter that he would bring his wife with him next time. He accordingly came in May with a lady, and they lived together as man and wife. The keeper of the tavern knew him, as he used to be there several times a year, and had seen Mrs. Hargrave in the house with him: but he did not know what lady was with him in 1836. Then it is not proved that the visitor in February was the husband, nor that Mrs. Hargrave was the person who went to the hotel with him in May. There was no concealment, however, made by the wife of her pregnancy or of the birth of the plaintiff; and six or seven months after his birth, his mother had him baptized by the name of John Robert Hargrave, the son of John and Mary Hargrave. I find nothing in the circumstances of the separation, or in the character or conduct of Hargrave, which renders intercourse in any degree improbable, nor does the alleged course of life of either make any difference. Even the alleged adultery of the wife, if proved, would not affect the question; and if I were bound to decide on the present state of facts, I would decide in favour of the legitimacy. As, however, there is some obscurity in the case, and there may be additional evidence produced, I think there ought to be a new trial, although I do not agree to the grounds on which the application has been made. I am the more inclined to grant this, as the Lord Chief Justice had latterly some doubts about the verdict being in accordance with the evidence, and the unfortunate death of that distinguished judge has prevented a revision of the case, which otherwise might have been made.' ('Law Times,' Nov. 21, 1846.)

At the second trial, which took place in the Common Pleas on the 22nd June 1848, direct evidence was adduced by the defendant to show that the husband was absent during the first two periods; and as it was admitted on both sides that the child was mature, the period of the end of April or beginning of May was considered to be inconsistent with its being the offspring of the husband, since this allowed only of a seven-months' gestation. Williams, J., who tried the case, left it to the jury—1st, whether entire absence on the part of the husband, at the only two periods at which he could in the course of nature have been the father of the child, had been clearly proved; and 2ndly, if not proved, and they thought the husband might have had access to the wife,—whether from the evidence he had availed himself of those opportunities. The jury returned a verdict for the defendant, thus finding the plaintiff illegitimate.

As if to show the great uncertainty attending suits of this kind, from conflicting evidence or the suppression or concealment of material facts, a third trial took place on the same issue in December 1850, when a verdict was returned for the plaintiff—again establishing his legitimacy, and thus restoring him to the position which he held by the verdict of the jury at the first trial.

Thus in reference to this question we find, on the one hand, some obstetric experts affirming that such a degree of maturity may be acquired at *seven-months'* gestation as to render it impossible to distinguish the child at birth from one born at the full period; and, on the other hand, obstetric experts of equal experience asserting that it is against all the laws of nature that children should be born full-grown even three weeks before the usual term. If the latter view be correct, there would be no difficulty in deciding, from appearances, whether a child had reached the seventh or the ninth month of gestation.

In another part of this work (*Uterine age*—INFANTICIDE), some cases are related which prove that at the ninth month children are occasionally born of a size and weight greatly exceeding the average. Thus a nine-months' child has been born weighing eighteen pounds and measuring thirty-two inches, whereas the usual weight is from six to seven pounds, and the length eighteen inches. In such an exceptional case, there is reason to believe that had the child come into the world at the seventh month, it would have appeared to the accoucheur to have reached the full term. As it is impossible to say when such an exception is likely to occur, and a lawyer is always entitled to take advantage of either extreme, it follows that in any case in which this question arises, a witness will be bound to admit that a seven-months' child may be born of the average size and weight of a nine-months' child, or to give some valid reason for the fact that great variations in size and weight may occur at the ninth but not at the seventh month of gestation. If the child is a male, and the testicles are found in the scrotum, there is every reason to believe that it has passed the seventh and even the eighth month of uterine life. (See INFANTICIDE.) The differences of opinion among obstetric experts in reference to this question appear to admit of explanation. All will agree that, as a general rule, a seven-months' child might be distinguished from a nine-months' child, unless the latter was a twin; but at the same time it must be admitted that if variations in development take place at the full term, there is nothing to prevent such variations from occurring at the seventh and eighth months of gestation. Dr. Hicks informs me that he has seen a child born seven months after marriage as large as at the full term; but, as he suggests, this child might really have been born at the full term. In order to determine this point by unexceptionable facts, it would be necessary to collect a series of cases of impregnation from one intercourse in which the children were born seven months after such intercourse, and were proved to have had the average size and weight of mature children. In the meantime counsel will care little for the rule, but will take advantage of the existence of admitted exceptions.

When the facts are such, that to be the offspring of the husband it must be a *six-months'* child, and it is born *mature*, there can be no room to doubt its illegitimacy. This question was raised in the Exchequer Sittings (January 1847), on a motion for a new trial in the case of *Eager* v. *Grimwood*. The action was one for seduction: and the principal witness in the cause, a young woman, on being cross-examined, stated that she was first connected with the defendant a few days before Christmas 1845, and that the birth of the child took place in the June following—*i.e.* in about six calendar months. Under these circumstances, as the child appeared to have been full-grown, the Chief Baron, assuming the statement of the dates to be correct, intimated it to be his opinion that the action could not be maintained, as the foundation of it was the loss of service, arising from the defendant's intercourse with the daughter, and her subsequent confinement, and that it was impossible that he could have been the father of the child in question. The jury found for the defendant. A rule for a new trial was granted, chiefly on the ground that the woman had, from confusion in giving her testimony, made a mistake in the period. This question may arise in cases of divorce, and the fact be received as proof of the act of adultery. In the case of *Maclean* (House of Lords, March 1851), it was proved that the earliest intercourse which could have been had with the husband was on the 22nd December 1847; while, according to the medical evidence, the child was born on the 6th July 1848, and was a full-grown nine-months' child. This was received as proof of adultery on the part of the wife. In *Heathcote's* case (March 1851), it was proved that the husband returned on the 24th November 1849, and the wife was delivered of a full-grown child on the 18th May 1850. This was also taken as proof of the alleged adultery. In *Hawkins'* case (May 1852), it was proved that there had been no access of the husband, owing to his absence, between the 16th May 1850 and the 23rd March 1851. A full-grown and *mature* child was born on the 2nd June 1851: hence, to have been the child of the husband, gestation must have been extended to a year and sixteen days, or reduced to a period of only seventy-one days. This was taken as clear proof of adultery on the part of the wife. It is to be remarked of this case that the husband had slept with his wife after his return, even up to five minutes of the time of her delivery, without suspecting his wife's pregnancy; and her female attendant, who had been in the habit of seeing her daily, did not observe any alteration in her personal appearance. This created a little difficulty in the case: but it merely serves to show, either that a visible prominence of the abdomen is by no means a constant accompaniment of the pregnant state, or that it may be very easily concealed.

Protracted births. Long periods of gestation.—The questions connected with retarded gestation have given rise to considerable discussion in legal medicine. That gestation may be retarded or protracted beyond the fortieth week is now, I believe, not disputed by any obstetric writer of reputation. Some accoucheurs have denied it, because they have not met with such cases; but the medico-legal relations of such questions do not depend upon the solitary experience of practitioners. It is only by the accumulation of well-ascertained facts from all authentic sources that medical knowledge can be made available for the purposes of the law; otherwise, owing to the mere accident of a witness not having met with any exceptional instance, a Court may be entirely misled in its judgment by trusting to his opinion. It is the more important to attend to this, because most of the cases involving questions either of contested legitimacy, or the chastity of females, turn upon protracted rather than upon premature delivery.

In standard works on Midwifery will be found authentic reports of cases in which gestation continued to the forty-first, forty-second, forty-third, and even to the forty-fourth week. Dr. Murphy regards 301 days, or forty-three weeks, as the average limit of gestation. ('Obstetric Report,' p. 4.) Dr. Lee met with a case in which he had no doubt that the pregnancy lasted 287 days: the labour did not take place until forty-one weeks after the departure of the husband of the lady for the West Indies. ('Med. Gaz.' vol. 31, p. 917.) Dr. William Hunter met with two instances in which gestation was protracted until the forty-second week. Dr. Montgomery met with a case in which delivery did not ensue until between the forty-second and forty-fourth weeks. ('Med. Gaz.' vol. 19, p. 646.) Dr. Merriman has published a valuable table on the subject of protracted gestation, on which the most experienced accoucheurs have been in the habit of relying. Of 114 pregnancies, calculated by him from the last day at which the females menstruated, and in which the children appeared to be mature, the following were the periods:—

In the 37th week . . .	3	In the 41st week . . .	22
„ 38th „ . . .	13	„ 42nd „ . . .	15
„ 39th „ . . .	14	„ 43rd „ . . .	10
„ 40th „ . . .	33	„ 44th „ . . .	4

Another well-marked case, occurring forty-four weeks precisely after the cessation of the menses, has been communicated to me by Dr. S. W. J. Merriman.

From these results Dr. Merriman considers that in the greater number of women gestation is completed in the fortieth week from the cessation of the menses, and next to this period in the forty-first. In the evidence given by this gentleman before the House of Lords in 1825, the case of longest protraction on which he was able to rely was that of a married woman, who was in the habit of calculating from the last day on which her monthly period ceased. This lady was delivered 309 days, or forty-four weeks and one day, from the time at which she supposed that she had conceived. In another case mentioned by the witness the period was 303 days, or forty-three weeks and two days from the termination of the last monthly period. It was objected to this evidence, by the Attorney-General, that it was impossible to fix the exact date of conception, and, as the female might have really conceived only a day or two before the expected return of menstruation, twenty-eight days (or four weeks) should be deducted from the periods assigned by the witness. Admitting the validity of this objection—and the fact upon which it is based is indisputable—it followed that the longest-protracted case observed by Dr. Merriman might have really been only a case of ordinary gestation extending to forty weeks and one day. An objection of this kind may of course be successfully urged in law to any inference from a calculation so made, and it was thus that in the Gardner Peerage case the medical evidence failed to render it certain that gestation might be so protracted as to support the legitimacy of the claimant. It is therefore obviously of the greatest importance, in considering this question, to make full allowance for a possible error; and, in calculating the pregnancy from the last day of the last menstrual period, to deduct the interval of menstruation, if known, and at least twenty-eight days if unknown. It must be remembered that in these cases of contested legitimacy the offspring is commonly the result of a *single* intercourse. The date of conception is therefore fixed within limits already described (*ante*, p. 815); and a comparison can be instituted only between the period of gestation thence deduced, and the periods taken in other cases which are equally free from any error.

A well-marked case of gestation passing beyond what is commonly set down as the average period has been communicated to me by Mr. Howell, of Walton-on-Naze. This occurred in a healthy female, æt. 30, who had borne three children, the youngest being 4 years old. She had menstruated with regularity up to the third week in June: the menses then stopped without any apparent cause. Her delivery took place 323 days after their last appearance. Allowing that impregnation occurred at the intermenstrual period, this would make the gestation 309 days; or assuming that impregnation did not occur until twenty-eight days from the date of the last menstruation, this would make the period 295 days, or forty-two weeks and one day. Dr. Murphy, of University College, has also furnished me with some facts in reference to this subject. Out of 182 cases, in which special enquiries were made of the females, the deliveries took place from the date of the last appearance of the menses at the following periods in weeks. The details are given in his 'Report of the Obstetric Practice of University College Hospital for 1844':—

In the 33rd week . . .	5	In the 40th week . . .	25
,, 34th ,, . . .	3	,, 41st ,, . . .	32
,, 36th ,, . . .	6	,, 42nd ,, . . .	25
,, 37th ,, . . .	11	,, 43rd ,, . . .	19
,, 38th ,, . . .	12	,, 44th ,, . . .	9
,, 39th ,, (9 months) .	24	,, 45th ,, . . .	11

The most protracted of the cases in his table was No. 182; the period of gestation was 329 days, or, deducting twenty-eight days (the ascertained menstrual interval), 301 days, or forty-three weeks—*i.e.* three weeks beyond the usual period. Dr. Hedrich mentions, in the 'Neue Zeitschrift für Geburtskunde,' the case of a woman whom he attended in her first labour, who was delivered on the 309th day after intercourse. ('Am. Jour. Med. Sci.,' July 1845.) Dr. Beck reports a case which occurred in the United States in 1840, in which gestation was alleged to have been protracted to 313 days, or forty-four weeks and five days; and Dr. Murphy describes two cases which fell under his own observation, in one of which gestation was carried to 314, and in the other to 324 days. ('Obstetric Report,' 1844.) He subsequently met with a third case, in which, making due allowance for all the usual sources of error in the calculation, gestation occupied a period of 323 days. Dr. S. W. Merriman has given me a reference to a case, reported by Dr. Power in his work on 'Human Pregnancy,' in which gestation is said to have extended to 325 days. Mr. Chattaway of Knighton, a former pupil, has communicated to me a remarkable instance of protracted gestation. A healthy woman, æt. 36, the wife of a farmer, applied to him to attend her in her confinement, which she expected to take place in September 1856. The menses appeared for the last time in December 1855, and she quickened in the beginning of April 1856. About the middle of September (*i.e.* on the 283rd day, dating from the last menstruation), Mr. Chattaway was summoned to attend her, and he found her labouring under severe false pains; there was also a discharge of mucus tinged with blood. The case went on until the 19th November 1856, when the patient was delivered of a female child of the average size. It would thus appear, according to the ordinary mode of calculation, that deducting twenty-eight days from the last appearance of the menses, gestation was protracted in this instance to 330 days, or forty-seven weeks and one day.

These cases, assuming the facts to have been correctly observed and reported, meet the objections taken to the medical evidence in the Gardner Peerage case. All women may not have such unusually protracted pregnancies, —indeed, it is well ascertained that no two women are alike in this respect, and that two successive pregnancies in the same female are rarely alike in duration. Then, again, all practitioners may not have met with protracted cases; but the fact being clearly ascertained in one case, it is unnecessary to search for more, unless we doubt the credibility of reporters well qualified to observe, and who could have no conceivable motive to misrepresent the facts which came before them. On this part of the question I think it is unnecessary to argue. The advocates of a fixed and limitable period differ from each other by a space of at least ten or twelve days, and each must either take his own experience for the final decision of this question, or it must be allowed that men of equal powers of observation with themselves, have met with cases which have gone beyond their own fluctuating limits.

Protracted cases of gestation are always open to the objection that the menstrual function may have been suspended, from some hidden morbid cause, one or two months before the actual date of conception, and that there may have been some error in the calculation by which the period has been determined. If, however, the objection be admitted under these circumstances, it would be only equally just to admit that in any given case the ordinary and so-called fixed period, calculated from the cessation of menstruation, is based on a fallacy. The menstrual function may have accidentally ceased, or continued for several intervals after conception, and thus a corresponding change should be made in fixing the ordinary period of gestation. This view of the question implies that no reliance can be placed on the date of the cessation of the menses as evidence of the actual duration of pregnancy, whether natural, premature, or protracted. My colleague Dr. Hicks informs me that he met with a case in which the pregnancy of a woman appeared to be protracted to between twelve and thirteen months. There was every reason to believe that this woman became pregnant during the absence of the menses, and their suspension some time before intercourse had taken place; and this, no doubt, is the explanation of a large number of cases of alleged protracted gestation.

In the Gardner Peerage case, the Attorney-General was quite willing to rely upon the cessation of the menstrual discharge as a good criterion of the duration of pregnancy, when by such a mode of calculation this was not made to exceed forty weeks! But it is obvious that this condition must be either taken or rejected altogether as evidence: if taken, we have no right, in alleged protracted cases, to refer the suppression to disease, for the sake of shortening the period,—when in ordinary cases we do not refer its continuance to disease, because this would tend to lengthen it: if rejected, it would be in the highest degree unjust not to give to a claimant the beneficial presumption of his having been born legitimate, when the cases adduced in evidence against his claim are actually based upon a precisely similar mode of calculation!

It is difficult to admit that all the protracted cases recorded by different observers have depended upon mistakes being made in the calculation of the period, since this calculation is based on the same principles as those adopted in cases of ordinary pregnancy. Hence, if there is a mistake in the one case, there would be in the other: if an error in the exception, there would be an error in the rule. Either the average term of pregnancy is wrongly calculated by most accoucheurs at the thirty-eighth or fortieth week, or it is rightly calculated to extend occasionally to the forty-fourth or, admitting these protracted cases, to the *forty-sixth* week. But, even setting aside the obvious answer to an objection of this nature, some of the cases observed were instances of impregnation from a single intercourse; and, making due allowance for the interval for conception, the general inference would not be affected, and no fallacy could have arisen in these cases of protraction, from mistakes dependent on the cessation of menstruation.

Some instructive papers on this subject have been published by the late Dr. Reid. (See 'Lancet,' Sept. 3 and 10, 1853, pp. 205 and 235.) The conclusions at which Dr. Reid has arrived are decidedly adverse to the views of Dr. Murphy regarding the great duration of pregnancy. He states truly, that an accidental arrest of the menstrual discharge may take place for three, four, or many successive periods, while impregnation may have occurred at any time during this suspension. Under these circumstances, a calculation based on the date of the suspension of the discharge would, of course, be erroneous; and 'the number of days which elapse after the last menstrual appearance is not, therefore, *any proof* of the real extent of gestation in otherwise doubtful cases.' In one case which he reports, labour occurred 294 days after menstruation, but 278 days after intercourse; in a second, 287 days after menstruation, but 276 days after intercourse; in a third, 281 days after menstruation, but 277 days after intercourse; and in a fourth 294 days after menstruation, but 279 only from the earliest possible time of conception (intercourse). It will be perceived that while the dates from intercourse varied slightly, those from menstruation varied considerably. In a case reported by Dr. Montgomery, the last menstruation was on the 18th of October. Impregnation (intercourse?) took place on the 10th of November, and parturition followed on the 17th of August. The interval between insemination (intercourse) and parturition was thus 280 days, and between the last menstruation and parturition it was about three weeks more—namely, 303 days.

Dr. Reid's conclusions, derived from numerous facts and cases, represent the views of an experienced observer on this much-disputed question. They are—'1. The duration of pregnancy is not altogether a fixed period: it varies somewhat in the human female, as it does in the lower orders of animals. 2. This deviation, however, is not to any great extent: the only *certain* data of calculation are those dependent on the *known time of conception* (of *intercourse?*). 3. The *average* duration of the pregnant state, when calculated from this event, is about 275 days, or it may have a range of from 270 to 280 days. 4. There is no full or satisfactory evidence of gestation having been prolonged beyond 293 days. 5. The Code Napoléon, which allows 300 days, may be regarded as liberal. 6. The menstrual period must generally serve as our guide in default of some exact knowledge: it is, however, often fallacious, and is only a means of approximation to the probable time of parturition. 7. The fortieth week after the last appearance of the menses is the most likely period, and the forty-first week the next.'

Dr. Duncan ('Edin. Monthly Journal,' 1854, vol. 9, p. 230) draws the following conclusions regarding the duration of pregnancy:—1. That the interval between conception and parturition (the real duration of pregnancy) has not been exactly ascertained in any case. 2. That the average interval between insemination (intercourse) and parturition (commonly called the duration of pregnancy) is 275 days. 3. That the average intervals between the end of menstruation and parturition have no standard length, but vary within certain limits. 4. That while absolute proof of the prolongation of real pregnancy beyond its usual limits is still deficient, there is evidence to establish the probability that it may be protracted beyond such limits to the extent of three or even four weeks.

It will be perceived from the conclusions drawn by Dr. Reid, that he admits a variation of 23 days, *i.e.*, from 270 days (the shortest period) to 293 days, the longest known to himself from a single intercourse. (See p. 813.) There appears to be no valid reason why the variation should not be even greater than that which is here assigned, and why the duration of pregnancy might not extend occasionally to 296 and even to 301 days. It is merely a question of individual experience. An accoucheur who admitted a variation of 23 days, and who had known gestation to be protracted to the 293rd day after intercourse, would hesitate to pronounce a child illegitimate merely because it had been born on the 296th or the 300th day after possible access of the husband. There is no doubt a limit to gestation, but it is not in our power to fix it: hence we find obstetric writers of repute adopting periods which have no point of agreement among themselves. Some stop short at 280 days; others, like Dr. Reid, fix the maximum yet known at 293 days; Dr. Murphy allows from his experience at least 324 days; and Dr. Meigs considers that gestation may be continued to twelve months, or 365 days. ('Obstetrics, the Science and the Art,' 1849, p. 194.) The fact is, the term has not yet been fixed even approximately by medical science: hence, in a disputed case, other circumstances must be looked to in order to lead a Court of Law to a safe decision. It is at present hopeless to reconcile the conflicting medical opinions which exist on the subject of the duration of pregnancy in the human female. There is, indeed only one point on which all modern observers agree—namely, that the period cannot be limited to a certain number of days, but that it is liable to variation according to circumstances but little understood.

It has been already observed (*ante*, p. 815) that the date of intercourse does not furnish us with the date of conception, and according to some authorities all evidence connected with the function of menstruation is untrustworthy. n spite of these objections, the menstrual period must generally serve as a guide in default of more certain criteria. It is, however, a curious fact, and one which the mind of an acute lawyer will not fail to appreciate, that the date of the cessation of the menses is taken by some physicians as a guide (in married life with constant intercourse), so long as gestation does not extend beyond 280 days; while, supposing it to extend to 300 days, they will assume that some other cause than pregnancy must have led to an earlier suppression, and thus to an error in the calculation! There may be no more evidence of suppression from a morbid cause in the one case than in the other, and the period of 280 days may be as much based on error as the period of 300 days. It is strange that clever writers, who adopt this mode of making facts square with a foregone conclusion, do not perceive that they must, in fairness, either reject altogether the evidence derived from the cessation of the menses, or admit it adversely to their own views, in cases in which the facts connected with the cessation have been as carefully observed and recorded by others as by themselves.

Period of gestation not fixed by law.—In all cases of contested legitimacy, the question respecting the duration of gestation, when it arises, is left entirely open by the English law. The French law, under the 'Code Napoléon,' allows 300 days, and the Prussian law 301 days; but no period has been fixed by English jurists within which, or beyond which, a child, if born in wedlock, will be presumed to be illegitimate. The decision of a Court of Law would be founded, quoad the duration of pregnancy, on the opinions of experts selected for the occasion, and each case would be decided on its own merits. Precedents can have but little influence on these occasions, because a Court may think fit to pronounce illegitimate, on non-medical grounds, a child born in the thirty-eighth week of gestation, while it may decide that another was legitimate that had been born in the forty-third week. By some law-authorities *forty* weeks (or 280 days), and by others forty-three weeks (or 291 days), have been taken as the '*ultimum tempus pariendi*'; but as the period of human gestation is wholly independent of any legal dictum, it is not the custom of Courts to act upon this as a rule. Nevertheless, it is clear in some extreme cases that the law may fairly interpose, and pronounce for a reasonable limit. In the case of *Cotterall* v. *Cotterall* (decided in the Consistory Court, July 1847), a child was born during the marriage, and the husband proceeded against the wife for a divorce on the ground of adultery. The main proof was based on the fact, that in order to have been the child of the husband it must have been born after *twelve months*' gestation. The husband left his wife in New South Wales, and was absent for that period of time without possibility of access. Dr. Lushington, without entering into the question of protracted gestation, upon proof of this allegation, at once pronounced for the divorce. Such a duration of pregnancy is not supported by any known facts, and is altogether opposed to medical probability. In an affiliation case, before Mr. Selfe at the Thames Police Court (Oct. 1857), proof was afforded that the putative father had been absent from England eleven months and six days before the child was born, and on this evidence the case was at once dismissed. In March 1859, a case was referred for my opinion from Scotland, in which it appeared that husband and wife had parted on the 23rd January 1858,—the husband having gone to the West Indies. A child was born on the 29th December following, *i.e.* 339 days (or forty-eight weeks and three days) from the time at which the husband parted from the wife. The child died, and a claim was made on a life-insurance society for a sum of money alleged to be due to the parents on account of this child. The society refused payment, on the ground that the child was illegitimate. My opinion was adverse to the claim: the length of the alleged gestation, and the state of the child when born, were sufficient to prove that it was not the child of the husband.

In *Anderton* v. *Gibbs* (1834), the Vice-Chancellor decided that a child born ten months (or about *forty-two weeks*) after intercourse with the husband was legitimate. A verdict had been already returned establishing the legitimacy of the plaintiff; and an attempt was now made to set this aside, among other grounds, upon the plea that the offspring was illegitimate, because it had been born at so long a period after possible access. It appeared that the mother of the plaintiff, for some time before and at the period of the birth, had been living in adulterous intercourse; and that about *ten months* before the birth of this child she had had a private interview with her husband, when it was assumed that there had been access, but the parties did not meet afterwards. Before the adultery, they had lived together two years without having had issue; and in the present instance the child was born after a period of *forty-two weeks*,—facts which were considered to establish its illegitimacy. The opinions of Sir Charles Clarke and other medical men were adduced at the trial, and these limited the extreme period of gestation to forty weeks; but they at the same time declared that the subject was involved in great uncertainty. The Vice-Chancellor considered that the jury at the trial had given a proper verdict by finding for the plaintiff's legitimacy. The jury were not to decide by whom the child had been *begotten*, but whether it could *by any possibility* be the child of the husband. With respect to the period of gestation, there was no difficulty. Sir Charles Clarke, and other authorities, confessed that the subject was involved in darkness and mystery, and that the Faculty of Medicine knew nothing certain about it. There was no positive evidence as to the exact day on which the child was born, nor on which the interview between the husband and wife took place; therefore this would allow of the period of gestation being reduced to about forty-two weeks, or less. The legitimacy of the plaintiff was in his opinion legally established. From this case it will be seen that a child may be affiliated on the husband, although the wife may be living at the same time in adulterous intercourse with another person.

Few trials in relation to legitimacy have excited more attention among jurists than the *Gardner Peerage* case, which came before the House of Lords in 1825. A full account of the medical evidence has been published by Dr. Lyall. ('Med. Evid. in Gardner Peerage Case', 1827.) Alan Legge Gardner, the son of Lord Gardner by his second wife, petitioned to have his name inscribed as a peer on the Parliament Roll. The peerage was, however, claimed by another person, Henry Fenton Jadis *alias* Gardner, who alleged that he was the son of Lord Gardner by his first and subsequently divorced wife. It was contended that the latter was illegitimate; and in order to establish this point, the evidence adduced was partly medical and partly moral. Lady Gardner, the mother of the alleged illegitimate child, parted from her husband, on board of his ship, on the 30th of January 1802. Lord Gardner went to the West Indies, and did not again see his wife until the 11th of July following. The child whose legitimacy was disputed, was born on the 8th of December of that year. Therefore the plain medical question, taking the extreme view, was whether a child born 311 days (*forty-four weeks and three days*,—from January to December), or 150 days (*twenty-one weeks and three days*,—from July to December) after possible intercourse could be the child of the husband, Lord Gardner. If these questions were answered in the affirmative, then it followed that this must have been either a premature or a protracted birth. There was no pretence that it was a premature case, the child having been *mature* when born. The question then was reduced to this—Was this alleged protracted gestation of 311 days consistent with medical experience? Many medical witnesses, comprising the principal obstetric practitioners in the kingdom, were examined on this point. Their evidence was conflicting, but a majority concurred in the opinion that natural gestation might be protracted to a period which would certainly cover the birth of the alleged illegitimate child. On the moral side of the question, it was clearly proved that Lady Gardner, after the departure of her husband, was living in open adulterous intercourse with a Mr. Jadis; and on this ground Lord Gardner obtained a divorce from her after his return. He subsequently married a second wife, by whom he had the claimant, Alan Legge Gardner. It was contended that the other claimant was really the son of Lady Gardner by Mr. Jadis. The decision of the House was that this claimant was illegitimate, and that the title should descend to the son of the second Lady Gardner.

The decision appears to have been chiefly based on moral circumstances: for had not the first Lady Gardner been living in adultery at the time of her husband's departure, it is highly probable, from the medical evidence bearing strongly that way, that the legitimacy of the child would have been admitted. Again, supposing the child had been born two or three weeks earlier, the question would have resolved itself into this: Who had begotten the child—the husband or the adulterer? This could not have been decided, and then, probably, as in the more recent case of *Anderton* v. *Gibbs* (suprà), the rule of law would have pronounced the husband to have been the father. The Judges must have considered that medical opinions, without cases to support them, could not be safely received. It is obvious that the possibility of gestation being protracted must stop somewhere, and it was probably thought that this point had here been passed. Morally speaking, the decision could not be impugned, but medically speaking it assumed that gestation could never be protracted to the 311th day after probable intercourse. Considering that conception is not necessarily the immediate result of intercourse (p. 815), and that we have no data for fixing the precise time of its occurrence, this decision could hardly be supported on medical grounds. We should not be justified in affirming that every child born forty-four weeks and three days after the opportunity of intercourse with the husband was *ex necessitate rei* an illegitimate child and that the wife was an adulteress. It is true that their Lordships did not decide directly that the one claimant was illegitimate, because he could have been born only after 311 days' gestation; but their decision practically led to this result, as the other claimant was pronounced to be the only son and rightful heir of Lord Gardner. Of the seventeen medical experts examined on this occasion, five supported the opinion that the duration of human pregnancy was *limited* to *about* nine calendar months, *i. e.* from thirty-nine to forty weeks, or from 273 to 280 days—or, strictly speaking, from 270 to 280 days: one of the witnesses, indeed, said from 265 to 280 days. These witnesses, of course, gave a negative to the possibility, unless by miracle, that Henry Fenton Jadis *alias* Gardner could have been the product of 311 days' gestation. On the other side, of twelve medical gentlemen, who seemed to agree with respect to the above-mentioned period as the natural term of gestation, the greater number maintained the *possibility* of pregnancy being protracted to nine-and-a-half, ten, or even eleven calendar months, and of course to 311 days,—the alleged term of gestation at which the counter-claimant was born—and they thus admitted the possibility that Mr. H. F. Jadis *alias* Gardner might be a ten-and-a-half months' child. (Lyall's 'Med. Evid. on the Duration of Pregnancy,' &c., p. 8.)

In the following case (*Luscombe* v. *Prettyjohn*, Exeter Summer Assizes, 1840) a period of less than 300 days—the time allowed by the laws of France and Prussia—was represented as falling beyond a time at which a child could be legitimately born. There was no medical evidence, and the jury declined to take the dictum of the learned judge on this question :—An action was brought against the defendant, by a farmer, to recover compensation for the loss of his daughter's services. It was alleged that the defendant had seduced her, and that she was delivered of a child of which he was the father. He denied that the child was his, among other reasons, on the ground that it was born 299 days (or forty-two weeks and five days) after intercourse. No medical evidence was called to show that gestation might be thus far protracted; but the learned judge, in summing up, is reported to have made the following observations:—'Upon the evidence it was almost *impossible* that he (the defendant) was the father. Supposing that she (the woman) were right, that would place the birth at nine calendar months, three weeks, and five days.' [The last meeting between the parties was had on the 9th of February, and the child was born on the 5th of December 1838, which is equal to an interval of 299 days.] After adverting to some medical authorities relative to gestation, he said:—'He would rather believe that she had yielded to some other attempt on her chastity, than that so wide a departure from the usual course of nature had taken place!' The jury did not concur in this view, and they returned a verdict for the plaintiff, thereby pronouncing an opinion, which is certainly borne out by medical experience, that the defendant might have been the father of the child, although *forty-two weeks and five days* had elapsed since the last access. ('Lancet,' Aug. 1840.) Had the verdict been the other way, there would have been fair ground, medically speaking, for a new trial; for the summing-up was undoubtedly made on an entirely mistaken view of medical doctrines. It amounted to this—that the chastity of every married woman who bears a child in the forty-third week of pregnancy after the absence or death of her husband is to be impeached, and the legitimacy of a child is to be set aside on bare proof of this fact!

In a well-marked instance of gestation from a single intercourse, noticed by Dr. Reid, the interval was 293 days,—only six days earlier than the period here pronounced to be incompatible with legitimacy; and by referring to the cases of Drs. Rigby and Merriman, it will be seen that the periods of gestation from a single intercourse have varied to a much greater degree than the two here placed in comparison (p. 813). This shows the risk to which the decision of such questions is exposed, when medical evidence is not called for on matters so strictly professional. The following case, which was tried in the United States (in January term, 1844), furnishes a contrast to that just quoted (*The Commonwealth* v. *Porter*: Cambria county, Pa.); the facts were somewhat similar:—The defendant was indicted for fornication and bastardy. The prosecutrix, aged 23, stated that she had had intercourse with the defendant on the 4th September 1842, and with no other person before or subsequently. She was delivered of a child on the 7th August 1843,—*i.e.* after 317 days, or *forty-five weeks and two days' gestation*; she swore that the defendant was the father of the child. The menses ceased about three weeks after intercourse, and they only appeared again slightly about five weeks before the child was born. At this time she had pains, which continued more or less until her delivery; she first knew that she was pregnant three or four weeks after intercourse. The defence was that, from the period of time which had elapsed, the defendant could not have been the father of the child. He therefore merely proved his absence, and that he did not return until after the birth of the child. No evidence was adduced to impeach the character or conduct of the woman. It was proved that she had always borne a good reputation, and that she had been seduced by the defendant under a promise of marriage. Dr. Rodrigue deposed that, in a practice of nineteen years, he had attended some hundreds of cases of midwifery, and the longest period of gestation which he had known was *ten months*. He considered the pains described by prosecutrix to have been the commencing pains of labour. The Court charged the jury strongly in favour of the medical testimony on protracted gestation, and they returned a verdict of guilty, thereby finding that the defendant was the father of the child. It transpired that a wife of one of the jurymen had during one pregnancy gone ten months. ('Amer. Jour. Med. Sciences,' Oct. 1845, p. 338.) Dr. Rodrigue, who reports this trial, states that a case subsequently came to his knowledge in which there was reason to believe that gestation had continued for a period of 320 days.

It would appear that the question of protracted gestation is frequently raised in the United States under these circumstances. Another case of bastardy (*The Commonwealth* v. *Hooner*) was tried in May 1846, in which the alleged duration of pregnancy must have been 313 days, or forty-four weeks and five days. The prosecutrix deposed that she had had intercourse with the defendant on the 23rd March 1845, and not subsequently—a fact established by the evidence; and the child, a large healthy male, was proved to have been born on the 30th January 1846. Twelve obstetric physicians were examined on this trial, and, as usual, they differed from each other. Some regarded it as possible, but not probable, that gestation might be so protracted as to reach 313 days; various medical works were quoted on the subject. The Court charged the jury that, although unusual and improbable, this length of gestation was not impossible; and they returned a verdict finding that the defendant was the father of the child. ('Dub. Med. Press,' 4th Nov., 1846, p. 296.) In the case of *Dyson* v. *Dyson* (Vice-Chancellor's Court, Feb. 18, 1852), it was proved that the husband left his wife in Madeira in Feb. 1849, that she returned to England in the August following, and that the child whose legitimacy was contested was born on the 8th Jan. 1850. It was contended that this was a case of protracted gestation; and the evidence of several medical men, to the effect that gestation might be protracted to 330 or even 336 days, was quoted in support of this view; in this instance there was a period of 336 days. The Vice-Chancellor, having referred to the Gardner Peerage case, declined to make a decree in favour of the legitimacy of the plaintiff. ('Legal Examiner,' Feb. 21, 1852.)

In extra-uterine pregnancy the fœtus may be carried for many years; Dr. Craddock relates a case, in which gestation was thus protracted for the very long period of twenty-two years. ('Phil. Med. Exam.' May 1846, p. 286.)

It will be seen, by the foregoing cases and remarks, that in these suits of contested legitimacy the general practice consists in establishing possibility of access on the part of the husband: when this is proved, the medical question arises, whether the term of gestation falls within the limits assigned by the best medical experience. In two instances, children have been pronounced legitimate, which were born, the one in forty-one weeks and three days, and the other in forty-one weeks and four days, after the death of the husband. Legitimacy has been allowed where gestation was probably protracted to the *forty-third week* (*Anderton* v. *Gibbs*, 1854). In the United States, a decision in favour of paternity has been made in a case in which gestation extended to *forty-five weeks* and two days (*Commonwealth* v. *Porter*, p. 837). Legitimacy has been disallowed in the English Courts, although probably on non-medical grounds, where it was protracted to *forty-four weeks* and three days (*Gardner Peerage case*, 1825); in one case paternity was denied (judicially) because gestation had extended to *forty-two weeks* and five days (*Luscombe* v. *Prettyjohn*, p. 837), and in another (*Dyson*, supra) because it had extended to *forty-eight weeks*.

Cases in reference to proof of access.—In the case of *Cope* v. *Cope* (North. Spring Circ. 1833) an action was brought by the plaintiff for his share of a legacy, to a part of which he declared himself entitled, as being the son of the deceased testator's brother. There was no doubt that the plaintiff was born during lawful wedlock; but it was contended that he was an illegitimate child—therefore it remained with the defendants to establish his illegitimacy by evidence. The defendants rested their case, first, on the entry in the parish register, which represented the plaintiff to be an illegitimate child; secondly, on *non-access* between the husband and wife. The husband, having separated from the wife, went to reside at about fourteen miles' distance from her. He was absent for several years; but it was contended that he was always within a short distance of the wife. During his absence the wife formed an illicit connection with another man, and at this time the plaintiff was born; but it was rendered probable that the husband had visited the wife before and after the birth of the child. It appears that both the mother and her husband regarded this child as illegitimate; and an attempt was made, on the part of the defendant's counsel, to put in declarations to that effect. But the Court interposed; and Alderson, B., said—'Lord Hardwicke had decided that the mother could not be allowed to give evidence on such a point, as she could not discharge the husband of the birth of the child; and *à fortiori* the husband could not be permitted to discharge himself. Lord Mansfield and Lord Hardwicke had both decided that illegitimacy could be proved only by the fact of there being no marriage, or by proof of non-access: and it was held, on the grounds of decency and morality, that the parties themselves should not be allowed to prove non-access after their marriage.' In summing-up, he further observed that—'If a child be born in marriage during the lifetime of the husband, that child in law is presumed to be legitimate. The plaintiff in this case is the youngest child, and was born after four other children, and during the lifetime of the reputed father; and he is in law, therefore, legitimate, unless the fact were proved, which it was for the jury to decide upon, viz. that the husband had not opportunities of access. If a husband have access, and others at the same time have criminal intimacy with his wife, still a child born in such a case is legitimate in the eye of the law. But if the parties are living separate, and the wife is notoriously living in open adultery, and the husband have opportunities of access, yet under such circumstances it would be monstrous to suppose that he would avail himself of these,—then the legitimacy of a child, so born, could not be established.' The jury returned a verdict for the plaintiff, finding that he was legitimate.

From this case we learn what kind of evidence the law requires in order to establish access or non-access. In order to defeat the legal presumption of access, where husband and wife are living near to each other, something more than mere probability of non-intercourse must be adduced. It is true that in this case the wife, while separated from her husband, was living in open adultery—but non-access of the husband was far from being clearly established. On the contrary, access was rendered *probable* by evidence:—therefore a verdict was returned, finding the plaintiff legitimate. It will be seen that very little value is set on baptismal registries as evidence of legitimacy, or the contrary; also that the declaration of a parent is not likely to be received by a Court as evidence of the illegitimacy of the reputed offspring.

The case of *Morris* v. *Davis*, which came before the Lord Chancellor in 1830, was a suit of contested legitimacy, which had been pending for eighteen years; and which was finally left by both parties to be disposed of by the judgment of his Lordship, on the facts and on the law of the case. The plaintiff was the son of a Mrs. Morris, and claimed to be the son of the husband; but it was contended that, although born in wedlock, he was illegitimate. The husband and wife had voluntarily separated, but lived for many years within a short distance of each other. The wife was living in adultery; and fourteen years after the separation from her husband this child, the plaintiff, was born. The wife saw her husband occasionally, but concealed the birth of the child from him. The man with whom she was cohabiting always treated the child as his own; and Mr. Morris remained for seventeen years in ignorance of its birth or even of its existence. His Lordship having stated the law of the case, as already given, said the question was one of fact, and not of law. There was an apparent difficulty in the case, owing to this,—that the parties, although separated, were proved to have met occasionally: there was therefore, unquestionably, opportunity of access,—but it so happened that *none of these meetings would correspond with the time requisite for the birth of the child* to render it legitimate. This fact, together with the general bad conduct of the mother, and her open adulterous intercourse, led him to pronounce that the plaintiff was an illegitimate child—that he was not the son of Mr. Morris. This judgment was not opposed to the rule of law, nor was it founded upon a mere balance of probabilities, but entirely upon the facts of the case. In the case of *Gurney* v. *Gurney* (Vice-Chancellor's Court, May 1863) a similar question arose, but the evidence clearly established that there had been no access in the interval between December 1859 and the date of the child's birth, in May 1861. In the case of *Plowes* v. *Bossey* (February 1862), the Vice-Chancellor decided in favour of the legitimacy of a child, although the husband was confined in a lunatic asylum—on the ground that the wife visited the lunatic, and intercourse might have taken place, in spite of the watchfulness of the keepers.

In a more recent case (*Atchley* v. *Sprigg*, January 1864), Vice-Chancellor Kindersley said that a child born of a married woman is presumed *primâ facie* to be legitimate—that is, to have been procreated by the husband,—and our law respected and supported the legitimacy of such child; and although it did not prohibit any person interested from making out the illegitimacy, it threw the *onus probandi* entirely upon him. If the case made by such person was that the husband and wife never were together within the period during which, according to the law of nature, they must have been to make the child the child of both, or that they were together either in company or under circumstances making the fact impossible, the onus was on him to prove it, and not on the other side. Moreover, where evidence was brought forward to prove illegitimacy, the Court did not treat the matter on the balance of probability, and the evidence must be such as to produce a judicial conviction that the child was not procreated by the husband. The question the judge had to ask himself, therefore, was whether, having considered the whole evidence, his mind was left in such a state as to convince him that the husband was *not* the father of the child. He was convinced, upon the whole, not that there was an impossibility that the husband ever could have had sexual intercourse with his wife (for that the law did not now require), but that such intercourse never did take place either during the period when the child must have been begotten, or at any other time from the year 1824, when they separated, until his death. Upon the whole, therefore, the case of the claimant must fail, the evidence of illegitimacy being such as to exclude all doubt.

PATERNITY.

CHAPTER 64.

DISPUTED PATERNITY—EVIDENCE FROM LIKENESS—DOUGLAS PEERAGE CASE—PARENTAL LIKENESS—AFFILIATION—POSTHUMOUS CHILDREN—SUPERFŒTATION IN RELATION TO LEGITIMACY—CIRCUMSTANCES UNDER WHICH IT IS SUPPOSED TO OCCUR—SUPERCONCEPTION—SUPPOSITITIOUS CHILDREN—RELATION OF THE SUBJECT TO FEIGNED DELIVERY AND LEGITIMACY.

Disputed paternity. Parental likeness.—It has been stated that the law does not pretend to determine who begat a child when it has been born during wedlock, and from circumstances it might be the child either of the husband or of an adulterer. But medical jurists have recommended that family-likeness should be looked to on these occasions,—not merely a likeness in *feature* and figure, but in gesture and other personal peculiarities which may have characterized the alleged parent. These are called questions of *paternity*: they seldom occur except in reference to cases of bastardy, and when they do present themselves, the evidence thus procured, even if affirmative, is properly regarded as only corroborative. In the *Townshend Peerage* case (House of Lords, May 1843), a presumption based on family-likeness was admitted by their Lordships. The party whose legitimacy was in question was sworn by one of the witnesses to bear so strong a likeness as a child to the alleged adulterer, that he should have known him among five hundred children.

The proceedings in the *Douglas Peerage* case (1767-9) show that evidence of this kind is occasionally of some importance. The peerage was claimed by Archibald Douglas—the survivor of two brothers after the death of the alleged parents, Sir John and Lady Douglas. The claim was disputed, on the ground that the appellant and his deceased brother were supposititious children. Evidence for and against the legitimacy of the claimant had been collected from every quarter, and after it had been most minutely sifted and criticized, the case came on for judgment, in the Court of Session in Scotland, on the 7th of July 1767. So important was the cause deemed, that the fifteen judges took eight days to deliver their opinions. The result was that seven of the judges voted in favour of the identity or legitimacy of Mr. Stewart, and seven against it: the Lord President, who had the casting-vote, agreed with the latter, by which Archibald Douglas, *alias* Stewart, was cast on the world without either name or estate—thus furnishing one among numerous instances that learned judges as well as doctors can differ with precisely the same facts before them. An appeal from this decision was taken to the House of Lords, by which the judgment of the Court of Session was reversed in 1769, and Archibald Stewart (or Douglas) declared to be the undoubted son of Lady Jane, the sister of the previous holder of the title. Much stress was laid, in favour of the legitimacy of these children, on the fact that they closely resembled—the one Sir John, and the other Lady Douglas. The resemblance was said to be general; it was evident in their features, gestures, and habits. Lord Mansfield, in delivering judgment, made the following remarks, which comprise all that can be said on this subject:—'I have always considered likeness as an argument of a child being the son of a parent, and the rather as the distinction between individuals in the human species is more discernible than between other animals. A man may survey ten thousand people before he sees two faces exactly alike; and in an army of a hundred thousand men, every man may be known from another. If there should be a likeness of feature, there may be a difference in the voice, gesture, or other characters, whereas a family-likeness runs generally through all of these: for in everything there is a resemblance, as of feature, voice, attitude, and action.' This kind of evidence has been strongly objected to from its uncertainty; and I am informed, on good authority, that it was in this instance much disputed whether one of the children did resemble Lady Douglas, but it seems to have been generally admitted that the other child resembled the husband, Sir John. From this account, it will be seen that evidence from family-likeness is not strictly medico-legal; it can be furnished only by friends and relatives who have known the parties well, and are competent to speak of the facts from personal acquaintance with them. It will also be apparent that the affirmative evidence in such cases will be stronger than that which is negative, for it could hardly be inferred that a person was illegitimate because he did not resemble his parent.

Parental likeness may be occasionally indicated by colour or peculiarities belonging to the varieties of mankind, as of the intermixture of the Negro or Mongolian with one of the Caucasian variety. In such a case the evidence afforded becomes much stronger; and supposing that two men of different varieties have intercourse about the same time with the same female, the colour of the skin of the offspring might enable a Court to determine the question of paternity. It is stated to have happened, on more than one occasion, that a black woman has given birth at the same time to a black child and a mulatto; and Dr. Cunningham refers to a case in which a negress gave birth to twins, one a black and the other a white child. ('Lancet,' May 9, 1846, p. 525.) This was probably a case of superconception. In *Stothard* v. *Aldridge* (Bail Court, January 1856), the plaintiff sued the defendant for damages for the seduction of his wife. The defendant was a man of colour, and the child born of the alleged adulterous intercourse, was proved by the medical witness to have been born coloured and with woolly hair. The husband and wife were both light. This peculiarity fixed the paternity of the child on the black defendant.

Personal *deformities* are not necessarily transmitted from parent to child; yet it would appear from the subjoined case, that a disputed question of affiliation has been settled on this principle. A woman alleged that a gentleman in whose service she had lived, was the father of a child of which she had been recently delivered. The solicitor who appeared to support the affiliation, rested his case chiefly on the fact that the child had been born with five fingers and a thumb on the right hand, the defendant himself having been born with a similar malformation on both of his hands. It was argued, on the other side, that the deformity might have arisen from the mother's imagination, as, while pregnant, she was constantly in the habit of seeing the defendant. The magistrates decided that he was the father of the child, and condemned him to pay the necessary expenses for its support. ('Med Times,' March 6, 1847, p. 47.) It is very likely that the decision was here influenced by moral circumstances, for otherwise the defendant might have been the victim of a coincidence. Six-fingered children are, it is well known, born occasionally of five-fingered parents: and as the deformity existed only on one hand in the child, while it was on both hands in the parent, the medical proof that it was actually transmitted by generation was certainly not clearly made out. In some instances attempts have been made to fix the paternity of a child by the *colour of the hair*, but this evidence is far less conclusive than that afforded by the colour of the skin. In the case of *Frazer* v. *Bagley* (Feb. 1844) it was alleged that the wife of the plaintiff had had criminal intercourse with the defendant, and the last two children were stated to be the offspring of the latter. The plaintiff and his wife had dark hair, as well as all the children with the exception of the two last :—these had red hair; and it was further proved that the defendant had red whiskers and sandy hair. No particular stress was laid upon this evidence, but it was received as a kind of indirect proof. Not much confidence can be placed in facts of this description, since red-haired children are often born to parents who have dark hair; and in one case the children born in wedlock were observed to have dark and red hair alternately.

Affiliation.—Questions of paternity are involved in those relating to *affiliation*. A party may allege that he is not the father of a particular child, by reason of certain circumstances upon which a medical opinion may be required. The necessary transmission of gonorrhœa or syphilis by intercourse may thus become a medical question. In September 1844 a man was required, under the law of bastardy, to support two children alleged by a female to be his; the time of gestation was within nine months. The accused denied that he had had intercourse with the deceased, or that he could have been the father, since he was at the time under medical treatment for venereal disease. The medical questions may therefore assume this shape :— 1. Are these diseases invariably transmitted by intercourse? 2. Do they interfere with the act of procreation? Under common circumstances they must both be answered in the negative.

A singular case of bastardy is reported to have occurred in Appenzell, Switzerland. The question was, which of two persons, who had had intercourse with the same woman within a period of *seventeen days*, was the father of an illegitimate child borne by the woman? The Council, to which the case was referred, gravely resolved to postpone their decision until the features of the child were so far developed as to enable them to decide from *paternal likeness*. The equity of this difficult case would have been met by compelling each man to contribute to the support of the child! (Schneider's 'Annalen der Staatsarzneikunde,' 1836, 1 B. s. 470.) The following, which is a more doubtful case, was the subject of a communication to the 'Lancet' (March 13, 1847, 336):—Two men, A and B, had intercourse, unknown to each other, with a young woman of delicate health; and after this had continued for some years, she was delivered of a female child—nine calendar months and three days after sexual intercourse with A, and nine calendar months, less five days, after similar intercourse with B; or at the end of 279 days after intercourse with A, and at the end of 271 days after intercourse with B:—that is, a period of *eight days* elapsed between the periods of intercourse of the two men. The woman had no menstrual discharge in the meantime, and it is not believed that she knew any other man; she went her full time, had a good labour, and produced a fine healthy girl; she had a plentiful supply of milk, and enjoyed better health during her pregnancy and suckling than at any other time. The woman died, and the circumstances of the mixed intercourse having become known to A and B, they both refused to maintain the child. A contended that, as the woman was not delivered until nine months and three days after the connection with him, it was physically impossible the child could be his. B contended, on the other hand, that 280 days, and not nine months, is the period of gestation; and that the child having been born 279 days after connection with A, and only 271 days after connection with B, it was therefore probable that the child was begotten by A.

There was no perceptible likeness to either of the men in the child, but a marked likeness to the mother. It is obvious, from the remarks elsewhere made (*ante*, p. 812), that the periods of 271 and 279 days are comprised within the ordinary range of gestation: hence there would be no *medical* ground for affiliating the child to one more than the other. When two men have intercourse with the same female on the same day, it is impossible to settle the paternity except by the accident of likeness; as in the former case, justice to the offspring and to each possible father requires that each should be bound to support the child. In cases of affiliation under the law of bastardy, the evidence of the mother, if corroborated, is received in support of a question of disputed paternity; sometimes these cases are decided by the length of the period of gestation. A man may prove, or a woman may state, that the intercourse took place at such a remote period as to be inconsistent with the ordinary duration of pregnancy. On this point some remarks have been made elsewhere (*ante*, p. 837). In the United States it appears that very long dates are allowed in bastardy cases; while in this country the tendency is to reject medical evidence altogether. In a case at Cheltenham (July 1853) the date of intercourse was proved to have been 319 days before the birth of the child. The medical evidence on the whole was in favour of this protraction—one of the witnesses having met with two cases in which gestation was protracted, as he believed, to 310 days from intercourse—but the case was summarily dismissed.

These questions of affiliation, when the interval is less than six or eight weeks, can rarely be determined by medical evidence; in a twin-case, it would be only just that one child should be affiliated to each individual. In a recent case of affiliation, an attempt was made to set aside the order of a magistrate fixing the paternity on the putative father, on the ground that, as the intercourse was had and the child conceived in France, although born in England, it was removed from the jurisdiction of an English magistrate, and should be left to the French Courts. The objection was properly overruled, and the alleged father was ordered to pay the usual sum for maintenance. The place of birth should properly fix the liability, as any other rule would be too vague. From that which has been elsewhere stated (*ante*, p. 816), the reader will perceive that in a given case, intercourse might take place in Scotland followed by conception in England and birth in Ireland. So that there is a due relation between the date of intercourse and the date of birth no other proof is required.

Posthumous children.—It has been supposed that a case involving a question of paternity might present itself on the marriage of a widow soon after the death of her first husband. If a child were born after the lapse of ten months, it might be a question whether it was a child of the first or second marriage—of the dead or the living husband; and although there might be no dispute concerning its legitimacy, yet it would be difficult to settle its *paternity*. Such a case appears hypothetical. In order that any doubt should exist, a woman must marry within, at the furthest, *six weeks* after the death of her first husband, or the birth of the child would fall beyond the furthest limit of gestation, so far as he was concerned. The customs of society are, however, a bar to such marriages; and admitting that a child was so born, and that it might be the offspring of either husband, then the fact of its having been born during the marriage of the second husband would presumptively fix the offspring upon him, unless it could be shown that there was no possibility of access on his part. If there was a supposed greater likeness to the first than the second husband, still this would not be allowed to defeat the legal presumption of the real parentage of the child. It appears to me that evidence much stronger than this would be required for such a purpose. (See Henke's 'Zeitschrift,' 1838, vol. 2, p. 432.)

SUPERFŒTATION.

Superfœtation in relation to legitimacy.—Most medico-legal writers, in treating legitimacy, have considered it necessary to introduce the subject of superfœtation. By this we are to understand that a second conception may at any time follow the first, and that gestation may go on to its full period in each instance independently of the other: so that if a woman were impregnated when in the third month of gestation, she would bear the first child mature at nine months, and the second child, also mature, at the end of twelve months after the first conception. This subject has been said to involve 'not only the conjugal fidelity of a wife, but the disposition of property, and much of the comfort and happiness of society.' Its importance to a medical jurist appears to me to have been here considerably exaggerated. So far as I have been able to ascertain, not only is there no legal case involving this question to be met with in the judicial records of this country, but none in reference to this state is ever likely to occur which would create the least practical difficulty. If we admit that a woman may, during marriage, present such a deviation from the common course of nature, as to produce two perfectly mature and fully-developed children, the one three or four months after the other, how can such an event be any imputation on her fidelity? Superfœtation, if it occur at all, may occur as readily in married life, during connubial intercourse, as among unmarried females. The following appears to be the only possible case wherein a medical opinion might be required respecting this alleged phenomenon. A married woman, six months after the absence or death of her first husband, gives birth to an apparently mature child, that dies: three months afterwards, and nine months after the absence or death of her husband, she may allege that she has given birth to another child, also mature. A medical question may arise, whether two mature children could be so born, that the birth of one should follow three months after the birth of the other; or whether this might not be a case, by no means uncommon, of twin-children—the one being born prematurely, and the other at the full period. (For a case of this kind, at two months' interval, see 'Med. Gaz.' vol. 37, p. 27; and for another, at eight days' interval, see the same journal, vol. 47, p. 227; for a third, at thirty-two days' interval, 'Am. Jour. Med. Sci.,' April 1845, p. 503.) Mr. Brown has more recently published a case in which abortion of one fœtus occurred at the third month, while the other attained the full period. ('Assoc. Medical Journal,' November 11, 1853, p. 997.)

Admitting that both the children when born were mature, and therefore that it was a case of superfœtation, the first delivery must have taken place in the presence of witnesses, and it would then have been known whether another child remained in the uterus or not. If the two children were born within the common period of gestation after the absence or death of the husband, then their legitimacy would be presumed, until the fact of non-access was clearly established. The mere circumstance of their being apparently mature, and born at different periods, would *per se* furnish no evidence of their illegitimacy. On the other hand, if one or both of them were born out of the ordinary period, then, according to the evidence given, they might or might not be pronounced illegitimate. The law therefore appears to have no sort of cognizance of the subject of superfœtation, as such: it is generally merged in the question of protracted gestation, which has already been fully considered.

Whether superfœtation can really take place or not, is a question which has given rise to much controversy. That one conception may follow another within a certain period, and that twins may thus be the result of two distinct conceptions, is a probable occurrence. This, indeed, is what may be termed *Superconception.* But when gestation has already gone to the second month, it has been hitherto considered highly improbable that there should be a second conception. In two cases, however, in which two men had intercourse with females within the period of seventeen and eight days respectively—cases favourable to superconception,—there was, in each case, only one child, and the paternity was actually disputed. (See p. 843.) According to Donné, there is a limit to this power of superconception. He has found that the mucus secreted from the vagina of pregnant females is, by reason of its great acidity, completely destructive of the existence of the spermatozoa, and therefore renders the spermatic fluid unprolific. (See post, STERILITY.) It does not appear, however, that the vaginal mucus becomes more acid in the pregnant state; but, according to Mr. Whitehead, the effect is due to this acid secretion not being partially neutralized, as in the unimpregnated state, by the alkaline mucous secretion of the uterus. ('On Abortion,' p. 406.) At what period of pregnancy the vaginal mucus begins to act destructively on the spermatozoa has not yet been determined; further researches are required to determine this point.

In a paper published in the 'Association Journal' (May 6, 1853, p. 398), Dr. Duncan, referring to the occurrence of menstruation during the early months of pregnancy, considers that he has obtained anatomical proofs that this discharge may take place from the inner surface of the uterus after impregnation, and up to the *third* month of gestation. He believes that during this period superconception may occur, and that this will satisfactorily account for all the cases of superfœtation which are on record. We may suppose that the first child is born prematurely, but within the limits of viability: we thus gain two months: and if impregnation may take place between two and three months after one conception, we may thus have four or five months' interval between the births of successive viable infants. It is not therefore necessary to suppose that they have both been conceived at the same time. Until the mouth of the uterus is completely closed as a result of the development of an embryo, it is possible that conception may take place from intercourse subsequently to a previous conception. The exact period at which this closure occurs has not been determined; but according to Dr. Duncan the menstrual secretion may find its way through the mouth of the uterus for at least *two months* and probably three months after conception. If this be the case, a second conception might occur two or three months after a first conception; but I am not aware of any facts to support this statement. It cannot be denied that superconception may occur in cases in which two separate intercourses have been had within a few days of each other; and, according to some, twins may be generally regarded as the result of this double conception at different periods. (Ramsbotham's 'Obstet. Med.' p. 500.)

Dr. Carter has reported the following case in the 'Philadelphia Medical Examiner':—A negro woman, quite black, æt. 23, and of good constitution, had borne three children previously to her last labour. She stated that in April 1848 she had had connection with a white man, and on the following day with a black man. This was about a week or ten days before the cessation of the menses. In the middle of February 1849 she was delivered of twins, one of the children (the firstborn) being as dark as negro children generally are, while the other was a mulatto. The woman believed that they were begotten by different fathers; and this was rendered highly probable by the difference in the colour of the skin. ('Edin. Month. Jour.,' May 1850,

p. 485: see *ante*, p. 842.) The reader will find several cases of a similar kind reported by Dr. Ramsbotham. (Op. cit. p. 501.)

Many of the old cases of superfœtation are explicable on the supposition that a woman was pregnant with twins, and that one of these was born prematurely, and the other at the full time, or later. The following, reported by Dr. Möbus of Dieburg (Henke's 'Zeitschrift der S. A.,' 1837), will serve as an illustration:—A healthy *married* woman, about thirty-five years of age, was safely delivered of a girl on the 16th of October, 1833. This child is described as having been well formed, and having borne about it all the signs of maturity. This woman, it is to be observed, had previously had several children in a regular manner. Soon after her delivery and the expulsion of the placenta, she felt, on this occasion, something still moving within her. On examination, the mouth of the uterus was found completely contracted, and the organ itself so drawn up as to render it difficult to be reached: but the motions of a second child were still plainly distinguishable through the parietes of the distended abdomen. Her delivery was not followed by the appearance of the discharges (lochia), or by the secretion of milk. The breasts remained flaccid, and there was no fever. On the 18th of November, *thirty-three* days after her first confinement, this woman, while alone and unassisted, was suddenly delivered of another girl, which, according to Dr. Möbus, was healthy, and bore no signs of *over-maturity* about it. The reporter alleges that this case most unequivocally establishes the doctrine of superfœtation. The two births took place at an interval of *thirty-three* days, and the two children were, it is stated, when born, equally well-formed and mature: but Dr. Möbus did not see the second child until twenty-four hours after birth. This may, however, have been a twin-case, in which one child was born before the other. Dr. Möbus considers that the first child was born at the usual period of gestation, it being described as mature; and the other, thirty-three days after that period, having been, in his view, conceived so many days later than the first child. If, however, we imagine that in this, as it often happens in twin-cases, one twin was more developed than the other, and that the more developed was the first expelled; or that it is not always easy to compare the degree of development in two children, when one is born before the other and they are not seen together, we shall have an explanation of the facts, without resorting to the hypothesis of a second conception after so long an interval. As to the signs of *over-maturity* alluded to, they are not met with. If we are to believe authentic reports, a child born at the thirty-ninth week cannot be distinguished from one born at the forty-third or forty-fourth week (*ante*, p. 843), and children born at the full period vary much in size and weight. A longer time may be required to bring children to maturity in some women than in others; and in a woman with twins it is well known that two children may arrive at the same degree of maturity within different periods,—one requiring, perhaps, several weeks longer than the other for its full development.

Cases of abortion or delivery of one twin, the other remaining in utero, are by no means uncommon. In addition to those already quoted, two are referred to in the 'Edinburgh Medical and Surgical Journal' (1839, p. 289). In one, abortion took place at three months, while the woman went to her full time and was delivered of a healthy child at nine months. In the second, one fœtus was expelled at about four-and-a-half months, while four months afterwards a full-grown child was born. In a third case, reported by Dr. Nevins, a woman was delivered of a fœtus, prematurely; and six weeks afterwards she was confined of a full-grown child. ('Med. Gaz.,' vol. 46, p. 983; see also 'Med. Times and Gaz.,' May 2, 1857.) Even under a malformation which might be supposed to be favourable to its occurrence, namely, the presence of a bilocular uterus, it has been found that impregnation has taken place in one cornu only. (See 'Med. Gaz.,' vol. 19, p. 507.) A singular instance is, however, recorded in the same journal (vol. 20, p. 508), where a woman, six months after marriage, bore a four-months' child, and forty weeks after marriage gave birth to mature twins. On examination, the uterus and vagina were both found double, and each vagina had a separate orifice. Dr. Horlbeck, U. S., states that he met with a case in which a well-grown fœtus of six months was simultaneously expelled with an embryo about six weeks old! ('Med. Gaz.,' vol. 44, p. 87.) In the 'Medical Times' (Jan. 31, 1852, p. 104), Dr. Foley has published the account of a case in which a mole was expelled from the uterus at an early period of pregnancy, while the female was delivered, about the usual period, of a living and well-formed although weakly child, which survived its birth three days. (See also 'Dublin Quarterly Journal,' Feb. 1859, p. 221; and 'Lancet,' August 2, 1862.)

The subject of superfœtation has been lately examined in another aspect by Dr. G. L. Bonnar of Cupar-Fife, and some of the facts which he has brought forward are not consistent with the theory of the births of twins at different intervals ('A Critical Inquiry regarding Superfœtation, with Cases,' 1865). The first question to which his researches are directed is, at what period after parturition are the female procreative organs capable of again exercising their functions? It has been supposed that a period of thirty days must elapse in order to enable the organs to reacquire procreative power; but, according to Dr. Bonnar, the earliest period may be taken at the *fourteenth day* after delivery. Impregnation is not likely to take place until the organs have resumed their natural condition, and this will depend on the disappearance of the signs of recent delivery—such as the tender and swollen state of the vagina, the enlargement of the uterus with its relaxed mouth, and the lochial discharge. The persistence of the lochial discharge, the average duration of which after delivery Dr. Bonnar considers to be from one to three or four weeks, is of the greatest importance, as it is most likely to interfere with impregnation. The time for the restoration of the sexual organs to their natural state varies in different women, so that the date for re-impregnation must be more or less conjectural. Thus, in reference to the lochia, it has been elsewhere stated (p. 762), that the discharge may be absent on the third day after delivery. When the child is not suckled by the woman, this discharge is said to continue longer and is more abundant than in other cases; although popular prejudice is the other way—as women generally consider that re-impregnation is not likely to take place so long as suckling is continued.

Another point for consideration is, what is the earliest period at which a child born can be reared? Without reverting to rare cases, such as the Kinghorn case, in which a child survived upwards of seven months, although born on the 174th day after intercourse, Dr. Bonnar is satisfied to rest upon Dr. W. Hunter's statement; and he therefore assumes 210 days, or seven calendar months, as the minimum period of uterine life at which a child should be born in order to be reared, or to have the power of living to manhood. With these data the following, among other cases, are cited to show the great probability of superfœtation occurring in married life. The Hon. Arthur Cole Hamilton, second son of the first Lord Mountflorence, married in 1780, Letitia, daughter of Claudius Hamilton, and had a son, born on the 7th July 1781, who lived to maturity, and a daughter, Letitia, born on the 5th January 1782, who lived and married Major Stafford. Between the two deliveries there was an interval of only 182 days; but, assuming that there was no prolific intercourse until fourteen days after the first delivery, the time for the gestation of the second child, which reached maturity, is reduced to 168 days. This case does not necessarily prove that the second child was conceived before the first was born; for, as in the *Kinghorn* case, the child may have reached an exceptional state of maturity at an early period. The facts, however, being indisputable, clearly show that the allegation of unchastity made in the *Kinghorn* case (p. 821), because a child born on the 174th day survived its birth for seven months, was wholly unfounded. Assuming—what is improbable—that the second impregnation took place immediately after the first delivery, the whole period is less by twenty-eight days than that which Dr. W. Hunter has assigned as necessary in order that a child should live and be reared.

But Dr. Hunter's period, compared with the results of modern experience, is placed too high. Dr. Bonnar has drawn up, from authentic sources, a table of eleven cases of children born at the end of the sixth month (180 days) who survived from eight days to fifteen years. Hence it may be inferred that, under favourable circumstances, when a child is well developed and healthy, a period of 180 days is the earliest at which it may be born and reared. But other facts show that even a shorter period will suffice. 1. William, first Baron Auckland, married Eleanor, second daughter of Sir Gilbert Elliot, Bart., and sister of Gilbert, first Earl of Minto, by whom he had fourteen children: amongst whom the fourth was the Hon. Caroline, born on the 29th July 1781, who lived sixty years, and the fifth the Hon. William Frederick Elliot, who was born on the 19th January 1782, and survived twenty-eight years. The interval between the two deliveries was 174 days, and, allowing that fruitful intercourse took place a week after the first delivery, this would leave 167 days for the birth of a child showing its powers of life by reaching the age of 28 years. This is thirteen days less than the period fixed by experience for the rearing, and forty-three days less than the period assigned by Dr. Hunter for the gestation, of a child which could be born with sufficient strength to attain manhood. 2. Lord Cecil James Gordon, brother to the late Marquis of Huntly, married the eldest daughter of Maurice Crosby Moore, Esq., County Tipperary, Ireland; and had a child, Evelyn, born on the 19th September 1849, and a son, Cecil Crosbie, born on the 24th January 1850, both of whom are now living (1865). These dates leave an interval between the two deliveries of only 127 days; and, deducting a week, the gestation of the second child, which has reached the age of 15 years, would be only 120 days, or four calendar months.

As there is no record of the weight and appearance of the second children when born, and, at the same time, nothing to show that they were immature, one of two conclusions must be drawn—either (as in the last case) that a child of four months may be reared, or that a second conception took place in each instance during the gestation of the first child. Assuming the correctness of the dates, I quite agree with Dr. Bonnar that they furnish much more trustworthy evidence of the probable existence of superfœtation (superconception) than any of the cases hitherto adduced, in which a judgment has been based on the appearance of the children when born, or on the incorrect modes of calculation commonly adopted by women. The previous births are sufficient to limit the period of conception far more accurately than the feelings of the mother (op. cit. p. 18).

It has been usually considered that after the second or third month the cavity of the uterus is so sealed up in the development of the embryo as a result of impregnation, that it is impossible that any fruitful intercourse can take place. In the two cases above-mentioned, however, viable children were born at five-and-a-half and four months respectively after the first delivery. On the theory of superconception the uterine organs must have been susceptible of a second impregnation up to the fourth month of gestation. But if the children were not born mature, the power of re-impregnation must have existed for one or two months longer than the period usually assigned—*i. e.* up to the fifth and sixth month of a pregnancy already existing. These researches may help to explain some legal difficulties which have occurred in reference to gestation. They furnish a curious comment upon the suggestion made by some medical jurists, that superfœtation involves the conjugal fidelity of a wife, &c. (p. 845), for no suspicion of illegitimacy could be for a moment entertained simply on account of the shortness of the interval between the two deliveries of the same married woman.

Monstrosity and Superfœtation.—An extraordinary case of monstrosity, involving the questions of superfœtation and paternity, is stated to have occurred at Alexandria in Egypt. A Fellah woman was delivered of a dicephalous (two-headed) monster at apparently about the eighth month of uterine life, of which one head was *white*, and the other *black*, possessing in other respects the negro conformation, and this head was fully developed. The monster was born dead, and the mother died soon after her delivery. The change in the colour of the skin commenced at the neck of the black head, and was found by M. Prus, a physician at the port of Alexandria, to be due to the existence of a colouring-matter similar to that found in the skin of the negro race. The husband of the woman was a Fellah, whose skin was of a brownish colour. There were negro labourers in the port, but it could not be ascertained whether the woman had had intercourse with any of them. It is therefore impossible to say whether this was or was not a case of impregnation about the same time by two men of different races. Admitting that this occurred, it is difficult to understand why the black colour should have been confined to the head only. (See 'L'Union Médicale,' 5 Août, 1848.)

SUPPOSITITIOUS CHILDREN.

Another medico-legal case, in relation to legitimacy, occurs when a woman feigns delivery, and represents the child of another person to be her offspring. She may substitute the living child of another woman for a dead child of which she herself has been delivered, or for a mole which may have passed from her. So, again, a male may be substituted for a female child, and *vice versâ*. The practising of a fraud of this nature may seriously affect the rights of inheritance of parties; but it cannot be accomplished without great dexterity and cunning, or without the co-operation of several accomplices. Frauds of this kind have, in general, been committed by the aid of a low class of midwives. One instance occurred at Chelsea, in July 1842, where the fraud was brought to light by the death of the supposititious child. The calling-in of a professional man would infallibly lead to discovery, when the question was simply whether delivery had or had not taken place; but if it be alleged that one living child has been substituted for another, the proof of this can depend on medical evidence, only when the age of the supposititious child does not happen to correspond to the date of the pretended delivery. (See 'Ann. d'Hyg.' 1829, vol. 2, p. 227.) The legitimacy of the claimant of the Douglas Peerage was disputed on this ground, but apparently without foundation (*ante*, p. 841). A remarkable case of this description will be found in Henke's 'Zeitschrift der S. A.' (1845, vol. 2, p. 172); and a trial took place some years since in England, involving the alleged substitution of a child, but requiring no medical evidence for its elucidation. (*Day* v. *Day*, Leicester Lent Ass. 1845.) In another case, elsewhere noticed (*ante*, p. 777), it was proved that a woman had substituted a doll for the dead body of a child of which she pretended she had been delivered. In a case mentioned by Dr. Chevers, one *Mussamut Janoo*, a midwife of Hissar, being employed to attend a woman in her confinement, persuaded her that the child of which she had been delivered was a monster with two heads, not fit to be looked at: she afterwards said that it was dead, and she would take it away and bury it. She accordingly went away. Next morning, the midwife's services being required, she was sent for. She excused herself from going under the pretence that she (the midwife) had just been delivered of a child. This improbable story excited suspicion, and the police were called in: she declared that the child was her own. This she also maintained at the trial. It appeared, however, from the evidence of midwives who examined her shortly after the discovery of the child in her house, and also by the deposition of the civil-surgeon, that she exhibited no signs of recent confinement. Several of the neighbours, who were constantly in the habit of seeing her, deposed that she had not exhibited any outward signs of pregnancy. She did not attempt to prove how she had disposed of the body of the child which she alleged had died immediately after its birth. She was convicted, and sentenced to imprisonment for seven years. ('Med. Jur. for India,' p. 512, from the 'Nizamut Adawlut Reports,' 26th April 1853.)

The manner in which an imposition of this kind may be carried out is well shown by a case which occurred in France. The female was in this instance a deaf-and-dumb married woman, and it appeared that her husband was in collusion with her. It was not in her power to make any disposition of some property to which the children of her marriage would be entitled, and by the advice of her husband she simulated pregnancy in order to deprive the heir-at-law of the property to which he would be entitled at her death. The facts, as far as they could be ascertained, were as follows:—The woman was 42 years of age, and although married for a period of twenty years, had borne no children. On this occasion, admitting her statement to be true, she was delivered without any medical assistance. All her acquaintances and friends were ready to depose that for six months she had presented the usual progressive appearance of real pregnancy, and that she had manifested the usual indisposition attending this state, including occasional faintings at the parish-church, &c.! For the heir-at-law it was contended that she had substituted, in her false accouchement, the child of a person named *Peyrins*, born only a few days before, and that she had made a false declaration of the birth. A midwife was ready to depose that the deaf-and-dumb woman had never been a mother. The decision in this singular case is not stated. ('Ann. d'Hyg.' 1847, vol. 1, p. 463.) It is obvious that it can only be by the coincidence of simultaneous delivery of another woman whose pregnancy is unsuspected, that a trick of this kind can be successfully practised. In all cases there must be a feigning of recent delivery, which a medical man of moderate acumen would be able to detect.

Cases involving a question of substitution are not very common. One of these (*Hutchins* v. *Hutchins*) was heard in the Vice-Chancellor's Court in May 1851; and in this the amount of ingenuity required to perpetrate the fraud was only equalled by the skill with which the facts were exposed, and justice ultimately done to the rightful claimant.

In one of the most recent cases (*Gedney* v. *Smith*, Rolls Court, Nov. 1864) the fraud was nearly successful, and, but for the dying declaration of the woman, would probably have escaped detection and exposure. The plaintiff claimed to be the only child of Mr. and Mrs. Gedney, and to be entitled to property under a marriage-settlement. Mr. and Mrs. Gedney were married in May 1851: from that time to 1854 there was no issue, although it was stated there had been several miscarriages. Mrs. Gedney, alleging that she was pregnant in 1853, came to London and took lodgings in the early part of 1864. On the 10th of February in that year, she was seized with the pains of labour, and sent for a man calling himself Dr. Goss, who, it was stated, delivered her of a female child—the plaintiff. Mr. Gedney then came up to London, dismissed Dr. Goss (with whom he was dissatisfied), and consulted Dr. Farre. The substance of this gentleman's evidence at the trial was that he was called in, as a perfect stranger, to attend Mrs. Gedney in her confinement on the Tuesday, as the lady was confined on the Friday previously; that he attended her from the 14th of February to the 7th of March; that it was an ordinary case of confinement—there was nothing unusual in the mother or child; that the child looked three or four days old when he first saw it; that he had no doubt he pursued the same mode of attending to the case as was resorted to in other similar cases—such as putting his hand on the uterus, abdomen, &c.; that it was not possible the lady could *not have been confined at all, &c.* The evidence of the reputed father, Mr. Gedney, was that his wife, according to her own statement, was pregnant in 1853, and that in February 1854 she came to London, not to be confined but for the purpose of procuring medical advice. He registered the child, and treated it as his own up to the time of his wife's death in March 1857, and it was not until then that he had any doubt that the plaintiff was his child.

On the part of the defendant, it was alleged that Mrs. Gedney had *not* been delivered of a child. Dr. Porter, her physician, who examined her body after death, deposed to this effect; and another physician, who attended her for the venereal disease in September 1853, stated that he did not believe that she was at that time pregnant. Three of the female servants of the family, who were much about her and saw her undressed, deposed that when she left for London, in February 1854, there was no appearance of her being pregnant. This was confirmed by the lodginghouse-keeper, and other persons who had full opportunities of judging of her condition.

It was further proved that Dr. and Mrs. Goss (the latter with a bundle under her cloak) called at the house on the afternoon of the day on which Mrs. Gedney was confined, and that they were alone in the room for some hours with Mrs. Gedney. During this time (from 4 to 11 p.m.) no nurse was procured, no noise of a child was heard; but various articles were asked for, and on the landlady entering the room in the evening, she was shown a baby, but it had no redness of skin about it like new-born children. She also saw some marks of blood &c. about the fireplace, and Dr. Goss told her that he had burnt the afterbirth. It was further shown that on the 4th of February, as Mrs. Gedney was alleged to have been confined on the 10th, a poor woman named Lydia Fletcher was confined of a female child at the York-road Lying-in Asylum; and that on the Tuesday previously to the 10th of February (which was on Friday) a gentleman and lady—afterwards identified as Dr. and Mrs. Goss—had called at the hospital and induced Lydia Fletcher to consent to give her child to them, in order that it might be adopted by a lady, who would bring it up as her own.

The child of Fletcher was proved to have been remarkably fair, with blue eyes, and this corresponded to the description of the child brought to the lodgings on the 10th of February. There was a total absence of parental likeness, as Mr. and Mrs. Gedney were dark. To support further the defendant's case a clergyman was called, who swore that Mrs. Gedney voluntarily confided to him that the plaintiff was a supposititious child, which she had adopted in order to recover the affections of her husband by appearing to have become a mother. This statement was borne out by a lady's-maid of Mrs. Gedney, who swore that her mistress had confided to her the whole secret of the deception put upon her husband and family: the testimony of the two differing mainly in the fact that to the former Mrs. Gedney was alleged to have stated she had been confined of a stillborn child, and to the latter that she had never been confined at all. Mrs. Gedney had subsequently, it was alleged, made to her father, on her deathbed, a confession of the whole deception; and this was the statement which came to the knowledge of Mr. Gedney on the day of his wife's funeral, and first raised in his mind a doubt whether the plaintiff was his own child. The jury returned a verdict for the defendants, thus denying the fact of the plaintiff being the child of Mr. and Mrs. Gedney.

The remarkable part of this case is, that the fraud had nearly succeeded. It had been perpetrated ten years before the trial, and did not come to the knowledge of the husband until after his wife's death. Was this woman delivered of a child at all? According to Dr. Porter, who examined her body after death, she had never borne a child. The reasons for this opinion are not given, but it is to be presumed that he found the uterine organs in the virgin state. The medical gentleman who was called in to attend her after the dismissal of Dr. Goss, stated that he saw her every day for the first week, every alternate day for the second week, and during the third week rather oftener. His opinion was that she had certainly been delivered of a child. The conflicting evidence on a simple matter-of-fact in this case points to the necessity, on the part of a practitioner, of making accurate notes of obstetric cases which come before him in a mysterious manner. These notes should include not only the medical facts, but the reasons upon which the opinions are based.

HERMAPHRODITISM.

CHAPTER 65.

SEXUAL MALFORMATION — HERMAPHRODITISM — ANDROGYNUS — ANDROGYNA — DISTINCTION OF SEX—MISTAKES IN THE SEX OF CHILDREN—CAUSES OF SEXUAL DEFORMITY IN THE FŒTUS—LEGAL RELATIONS—CASES IN WHICH THE DETERMINATION OF SEX IS NECESSARY—IMPUTATION OF HERMAPHRODITISM—REMOVAL OF SEXUAL PECULIARITIES BY OPERATION—THE RIGHTS OF ELECTORS DEPENDENT ON A NORMAL CONDITION OF THE SEXUAL ORGANS—CONCEALED SEX.

General remarks.—The legitimacy of a child is open to be contested under other circumstances than those connected with the duration of gestation. The alleged parent may have laboured under *physical incapacity*: if a male, he may have been affected with impotency—if a female, she may have laboured under sterility; and if either of these conditions be proved, the illegitimacy of a child will be established, although the alleged period of gestation may be comprised within the ordinary limits. The sexual conditions now about to be considered have also important bearings in relation to divorce, and occasionally to the civil rights of a child that may be the subject of the malformation. One of the most common and obvious causes of impotency or sterility is malformation of the sexual organs, to which species of monstrosity the term *Hermaphroditism* is commonly applied.

SEXUAL MALFORMATION.

Owing to arrested development, during the growth of the fœtus, the sexual organs, which can scarcely be distinguished at the fourth month, occasionally assume an abnormal arrangement. These organs appear to be at that time more or less mixed; and sometimes the male and at others the female characters predominate. With this defective sexual development, the other peculiarities of the sexes are either wanting, or we find them more or less blended. When, therefore, the being has the general characters of a male with malformation of the generative organs, it is called *androgynus*—when the characters are those of a female with a like malformation, *androgyna*. There can be no difficulty in identifying such cases, and, according to the degree of malformation, a medical jurist can have no hesitation in pronouncing these persons to be physically impotent. The organs are commonly so defective as to be wholly unfitted for the functions of either sex. It is not intended to be said that it is in all cases easy to assign the sex, but this is of minor importance: the main question is, whether the malformation is or is not such as to justify divorce, or to throw the imputation of illegitimacy upon children claiming to be the offspring of these beings?

Distinction of sex.—The determination of *sex* in these cases of *deformity* has been considered to be necessary under certain circumstances; as when, for instance, a title or entailed inheritance of lands is in question. Lord Coke has stated that, according to the law of England, an hermaphrodite may be either male or female, and it shall succeed according to the kind of sex which doth prevail. Thus it is obvious that the law will decide each case according to the special circumstances attending it, but it must not be supposed that the decision is so easy as Lord Coke's doctrine would imply. There are many cases in which neither sex can be said to prevail: the beings are positively neuter. The chief character of the male would consist in the presence of testicles, and of the female in the presence of a uterus and ovaries. But in a case which occurred to Mr. Grigor, both the testicles and the ovaries were wanting; there were no essential characters of either sex, and during life it would have been impossible to say whether this being was male or female. (Cormack's 'Monthly Journal,' July 1845, p. 492.) In the same journal (page 531) is reported another case, in which, notwithstanding the *external* resemblance to a female, the presence of one testicle in a scrotum showed that this individual was of the male sex: yet this person passed for a woman until he had reached his 26th year! It is rare that there is external malformation without internal defect, and even when the female character preponderates, it is not improbable that the uterus or the ovaries may be absent, or the former may be malformed. Such beings are not known to menstruate, and even if there be capacity for intercourse, they are permanently sterile. Sexual desires are, however, commonly absent. When the person is young, mistakes respecting the sex are more common than at an advanced period of life. So soon as the age of puberty is past, certain changes take place in the configuration of the body, which may aid a medical practitioner in forming an opinion. Thus a grave tone of voice, the presence of a beard, the width of the shoulders, and narrowness of the pelvis will indicate, *cæteris paribus*, the male sex; while when these conditions are absent, and there is a rotundity of the members, with want of prominence in the muscles, and a development of the breasts, the female sex predominates. Although no testicles are apparent, still the being may be of the male sex, since it is well known that in persons otherwise well-formed these organs occasionally are not found in the scrotum. Dr. Harris, of Clarkesville, has related a singular case, in which, although no testicles could be detected, there was a short but naturally-formed penis, through which the being regularly menstruated! The female character predominated in the corporeal development, and there was the rudiment of a vagina. ('Med. Gaz.' vol. 40, p. 562.) The fact that the being menstruated was here sufficient to cause it to be assigned to the female sex. How easily mistakes may be made in the sex of young children is shown by a case which occurred to Mr. Terry, and quoted in 'Cormack's Journal' (April 1845, p. 307).

The child was christened as a female, and was so considered by the parents for two months; when, owing to some defect in the passage of the urine, it was brought to Mr. Terry, and he found there was a malformation of the penis,—no vagina,—a scrotum with one testicle down and the other descending. He therefore pronounced it to be a male, and its costume was altered accordingly. The presence of a beard and whiskers is usually considered to characterize a male, but the growth of hair on the chin and face is sometimes as profuse in women as in men. Dr. Chowne examined a female named *Joseph Boisdechine*, on behalf of a man who was about to marry her, but who required a certificate as to the real sex of his intended wife! Dr. Chowne found nothing in her external conformation indicative of doubtful sex. The breasts were large and full, and the only resemblance to a male was in the abundance of beard and profuse whiskers. The upper lip was free from hair. (See 'Lancet,' Oct. 11, 1851, p. 335; Jan. 15, 1853, p. 66; 'Med. Times and Gaz.' January 15, 1853, p. 71.) Dr. Chowne has published a full account of this case in the 'Lancet' for May 1, 1852 (p. 421). He has appended an engraving, which displays the female beard and whiskers. It is stated that this female was born with a quantity of hair on her chin, and that at eight years of age the beard was two inches long!

In some cases an external examination will entirely fail to indicate the sex, and even the opportunity of an examination of the dead body may leave the case in doubt. An ingenious writer has laid it down that there are analogous organs in the two sexes which are never found in the same subject, and the separate existence of which would enable us to determine the sex. These analogous parts are the penis and the clitoris; the scrotum and the labia; the testicles and the ovaries; the prostate gland and the uterus. This, however, is an artificial and, as facts show, an incorrect means of distinction: see report of a case, in which a body resembling the prostate gland and a uterus coexisted in the same being ('Med. Times and Gaz.' February 18, 1860, p. 177). If a penis could always be clearly distinguished from a clitoris, and a scrotum from the labia, the rule might be serviceable; but it fails where it is most required, *i.e.* in the mixed conditions. As to the other means of distinction, even if correct, they will only enable an examiner to form an opinion of sex in the dead, whereas it is during the *life* of one of these beings that the law requires the aid of medical science in the solution of the question. The reader will find in the 'Medical Times and Gazette' an account of some remarkable cases of sexual malformation by Mr. Curling (January 24, 1852, p. 84); by Mr. Fletcher (February 7, 1852, p. 136); by Mr. Broadhurst (February 21, 1852, p. 187); and by Mr. Waters (May 21, 1853, p. 538). Other cases, reported by Mr. Mann and Mr. Churchill, will be found in the 'Association Journal,' 1853 (August 19, p. 720, and September 9, p. 799).

Mixed cases.—A case has been already mentioned in which neither testicles nor ovaries were found after death, and more than one instance has occurred in which both have been found. This last condition is a case of intermixture of the sexes, or, physically speaking, real hermaphroditism, but of course without the functional power of self-impregnation. The following case is mentioned by Briand:—The subject was about 18 years of age when he died. The body was partly that of a male in configuration, and partly that of a female. An examination of the sexual organs, externally, led to no satisfactory distinction; and on inspection after death a testicle was found in what was supposed to be the left labium, with an epididymis and a spermatic cord attached to it as usual; while on the other side were an ovary, Fallopian tube, and the rudiments of a uterus. The authenticity of this case was for some time a matter of dispute; but another, equally singular in its features, occurred to Prof. Mayer, of Bonn. This case clearly shows that such extraordinary deviations may be met with in nature. The person examined by Mayer died in 1835, at the age of 55. Different opinions had been formed respecting the sex by the first anatomists in Europe—some affirming that it was a male, while others contended that it was a female. This difference of opinion is sufficient to prove that an *external* examination does not always enable even a good anatomist to determine the probable sex of the being. In the dead body was found on the right side, a withered testicle, with a penis and prostate gland as male peculiarities; while on the left side there was an ovary, with a uterus, vagina, and Fallopian tube. ('Med. Gaz.' vol. 19, p. 135.) It should be stated that the general configuration of the body in this case was that of a female, but there was a duality of sex: the right half of the body was male, and the left half female. The case of a male with many of the special characters of the female will be found described in the 'Lancet' for August 15, 1863 (p. 183).

Causes.—The causes of malformation of the sexual organs, as of all other kinds of monstrosity, are involved in mystery. We know that in the early stage of utero-gestation the sex of a fœtus cannot be distinguished; while, even when it has reached the fourth month, the genital organs are so similar that the sex can seldom be determined on inspection. Some organs or parts appear to be formed by equal and symmetrical portions, which gradually approximate and unite in the median line of the body. We observe this mode of union in the bones of the head, chest, and spine, as also in the various fissures (*raphes*) of the skin, which are the remains of a union between two equal and symmetrical parts of an organ, now become one. In regard to defects in organization, it may be remarked that they almost invariably occur in or about some part of the median line; and they appear to proceed from a mere arrest of growth or development in these particular parts, either on one side or both, during the early stage of uterine existence. In this respect the fissures sometimes observed in the palatine bones, in the palate itself, or in the lip—the openings occasionally noticed in the chest, diaphragm, anterior parietes of the bladder, as well as in the spinal canal, are precisely analogous in origin to the defective development of the sexual organs. There is nothing absolutely removed or lost, but there is an arrest of development: an opening, or fissure, which nature intended to be only temporary, becomes permanent by reason of an arrest of growth. In the evolution of the male genital organs, the part corresponding to the scrotum is at first always divided by a considerable fissure: and the penis and the clitoris having, at this period of life, much the same kind of physical exterior, the sexual organs cannot be well defined. Should this fissure in the male not be afterwards filled up, then we shall have the most common variety of sexual malformation—the hermaphroditic form, with the male characters predominating. These observations are not, of course, applicable to those cases in which the sexes are positively mixed. In these instances there appears to be a separate sexual organization on the two sides of the body, with an imperfect development of each set of sexual organs. According to Weber, there is in the prostate gland of every male a rudimentary uterus. (Baly and Kirkes' 'Recent Advances in Physiology,' 1848, p. 112; also papers by Dr. Knox, 'Med. Gaz.' November and December, 1843.)

One circumstance is worthy of notice—namely, that sexual monstrosity appears occasionally to occur in the successive pregnancies of a well-formed woman. The late Dr. Lever met with a singular instance of this in a woman aged 28. She had given birth to four children in three confinements, the first being a twin-labour; both the children males, and in both there was an arrest of development of the sexual organs. On the third delivery the child was a male, and its sexual organs presented the same deformity as those of the twins. ('Med. Gaz.' vol. 38, p. 946.)

Medico-legal relations.—These beings, owing to defective development, are impotent and sterile. Questions connected with the legitimacy of offspring, divorce, and affiliation may, therefore, be raised with respect to them. This part of the subject will be considered hereafter (p. 880). Sexual monstrosity is not a ground for depriving a being of the rights of inheritance, except under peculiar legal conditions. Thus a right of succession or inheritance to landed estate may depend upon the *sex* of the offspring: as where, for instance, two children are born, the first an hermaphrodite, the second a well-formed male child. The parents die, and a title of nobility or lands may fall to the first-born male. Here the sex of the firstborn must be determined before possession can be had. In a case of this kind, if medical evidence should establish that male peculiarities predominate in the first-born, the second child would be cut off. Again, if an estate were limited by entailment, as where it is settled upon heirs (male or female) of a particular family, the birth of an hermaphrodite, an only child, would create the legal necessity for a positive determination of the predominance of sex. So, if an hermaphrodite live but a few minutes after birth, and then die, the rights of persons may be subsequently much affected by the medical attendant having come to an opinion respecting its sex. Since we cannot determine under what circumstances litigation may ensue, it is always right in a doubtful case to observe the sex, and make notes on the spot when a child thus malformed survives its birth but for a short period. The question of tenancy by courtesy, or the right of the husband to landed estate of which the wife was seised, will depend entirely upon the attention of the accoucheur to this point. (See *Tenancy by Courtesy*, *ante*, p. 800.)

When these beings have reached adult age, other questions may arise with respect to them. According to an old law of France, an hermaphrodite was permitted to choose one sex, and thereafter compelled to keep it! The English law is not so liberal: it does not allow them to select their sex, but determines it for them by medical evidence. Hermaphrodites, or sexual monsters, were formerly ranked with infamous persons; and it has been a grave question in our Courts, whether the calling a man an hermaphrodite was not such a libel or slander upon him as to render it a ground for a civil action. In a case reported by Chitty ('Med. Jur.' p. 374), the use of this term was held not to be actionable, unless it was proved that it had been attended with special damage. A dancing-master brought an action against a party for calling him an hermaphrodite, and it was decided that it was not sustainable:—1. Because such a union of the sexes cannot exist in fact, and everyone must be supposed to know it; consequently, the assertion could not be supposed to prejudice. 2. Because, admitting the possibility of such a double function, the party would be just as good, and perhaps even a safer, dancing-master than if only one perfect sex had been discoverable; consequently, the words would not, in legal presumption, injure him in his profession or occupation!

I am indebted to a learned member of the bar for a note on the remarkable case of the *Chevalier d'Eon*. There was a great dispute concerning the sex of the Chevalier, and it came before a Court of Law on an action to recover a wager under the following circumstances:—The plaintiff claimed of the defendant a sum of 300*l.* On the 4th of October 1771, plaintiff paid to defendant seventy-five guineas, on the condition that he, the plaintiff, should receive from the defendant a sum of 300*l.* in case the Chevalier d'Eon should at any time prove to be a female. (*Da Costa* v. *Jones*, 2nd vol. 'Cowper's Reports,' p. 729.) The case was tried before Lord Mansfield, at Guildhall;

and the jury found a verdict for the plaintiff, with 300*l.* damages, thereby affirming that the Chevalier was a *female*. A motion was subsequently made on behalf of the defendant to arrest the judgment, or at least to stay the proceedings, on the ground that the action could not be supported, as being upon a wager tending to introduce indecent evidence, and also as being one which materially affected the interests of a third person. The question thus raised on the motion was argued before the Court of King's Bench, and the judges unanimously agreed that the judgment must be arrested; the law not allowing wagers upon subjects leading to the introduction of indecent evidence (this being *contra bonos mores*), nor upon such subjects as are calculated to have an injurious effect upon the interest or character of a third person. Irrespective of this decision, the verdict was based upon what subsequently turned out to be untrue. The Chevalier was really a *male*, and not a female. He was carefully examined by Sir Anthony Carlisle, who satisfied all present of the perfect condition of his testicles. (See 'Paris and Fonblanque,' vol. 1, p. 229.)

It would appear, from a singular case reported by Dr. Barry, that in the United States the rights of citizenship, and the privilege of voting for members of Congress, have depended on the determination of sex. In March 1843 he was requested to examine the case of *Levi Suydam*, aged 23 years, a native of Salisbury, Con. At the exciting and warmly-contested election of the spring of that year, almost everything bearing the semblance of the human form, of the male sex, is stated to have been brought to the ballot-box. It was at this time, and under these circumstances, that the above-mentioned person was presented by the Whigs to be made a free*man*; he was challenged by the opposite party, on the ground that he was more a female than a male, and that in his physical organization he partook of both sexes. The following was the result of the *first* examination by Dr. Barry:—There was a mons veneris, covered with hair in the usual way; an imperforate penis, subject to erections, about two-and-a-half inches in length, with corresponding dimensions; the dorsum of the penis was connected by the cuticle and cellular membrane to the pubis, leaving about an inch and a half free, or not bound up, and towards the pubic region. This penis had a well-formed glans,—a depression in the usual place of the outlet for urine, with a well-defined prepuce. The scrotum was not fully developed, inasmuch as it was but half the usual size, and not pendulous. In the scrotum, and on the right side of the penis, there was one testicle, of the size of a common filbert, with a spermatic cord attached. In the perineum, at the root of the corpora cavernosa, an opening existed through which micturition was performed: this opening was large enough to admit the introduction of an ordinary-sized catheter. Having found a penis and one testicle, although imperfectly developed, Dr. Barry, without further examination, gave it as his opinion that the person in question was a *male citizen*, and consequently entitled to vote and enjoy all the privileges of a free*man*!

On the morning of the first Monday in April (election-day), Dr. Barry was informed that Dr. Ticknor would oppose this person's admission on medical grounds. Suydam came forward; and Dr. Ticknor objected to him as a *female*, and therefore not entitled to vote. Dr. Barry then stated to the meeting, that, from an examination he had made, he considered the person in question to be a male; and requested that Dr. Ticknor might, with the consent of Suydam, retire into an adjoining room, and examine him for himself. This was done, when Dr. Ticknor ultimately came to the conclusion that this person was really a male. He was accordingly admitted a free*man*, and his vote was received and registered.

A few days after the election, Dr. Barry heard that Suydam had regularly menstruated. His sister informed him (Dr. Barry) that she had washed for him for years, and that he menstruated as regularly, but not so profusely, as most women. When questioned, he very unwillingly confessed that such was the fact. He was again examined by the two physicians, when the following additional particulars were elicited :—Said Suydam is five feet two inches in height, light-coloured hair, fair complexion, with a beardless chin, and decidedly a sanguineous temperament, narrow shoulders, and broad hips—in short, every way of a feminine figure. There were well-developed breasts, with nipples and areolæ. On passing a female catheter into the opening through which micturition was performed, and through which he again stated he had a periodical bloody discharge monthly,—instead of traversing a canal and drawing off urine, the catheter appeared to enter immediately a passage similar to the vagina, three or four inches in depth, and in which there was a considerable play of the instrument. He stated that he had amorous desires, and that at this time his inclination was for the male sex: his feminine propensities—such as a fondness for gay colours, for pieces of calico, comparing and placing them together, an aversion for bodily labour, and an inability to perform the same, had been remarked by many. Dr. Barry further learned from an old lady, who was present at the birth of Suydam, that on the second day after his birth, Dr. Delamater, who attended as accoucheur, made with an instrument the opening through which he had ever since performed micturition. ('American Jour. of the Med. Sciences,' July 1847.)

This was certainly an embarrassing case,—one to which Lord Coke's rule for a decision, *i.e.* the prevalence of either sex, is hardly applicable. The presence of a penis and one testicle referred the being to the male sex, while the bodily configuration, and still more strongly the periodical menstrual discharge, referred him to the female sex. The right of voting might have been fairly objected to, because, while the female characters were decided, the organs indicative of the male sex are described as having been imperfectly developed.

Dr. Hartshorne, an American physician, quotes a case in which an attempt was made by Dr. Gross, a surgeon in the United States, to destroy all sexuality, and thereby all rights of citizenship, in the case of an infant whose sexual organs were imperfect. (A report of this case will be found in the 'American Journal of Med. Sci.' for Oct. 1852, and in the 'Edin. Monthly Jour.' for Jan. 1853.) The child, when seen by Dr. Gross, was 3 years of age, and had always up to that period been regarded as a girl, and in fact had been so pronounced at her birth by the accoucheur. At the age of 2 years she began to evince the taste, disposition, and feelings of the male sex: she rejected dolls and similar articles of amusement, and became fond of boyish sports. She was well-grown, perfectly healthy, and quite fleshy. Her hair was dark and long, the eyes black, and the whole expression most agreeable. A careful examination of the external genitals disclosed the following circumstances :—There was neither a penis nor a vagina; but instead of the former there was a small clitoris, and in place of the latter a superficial depression or cul-de-sac covered with mucous membrane, and devoid of everything like an aperture or inlet. The urethra occupied the usual situation (in the female?) and appeared to be natural; the nymphæ were remarkably diminutive, but the labia were well developed, and contained each a well-formed testicle quite as large and as firm as this organ generally is in boys at the same age. The hips, chest, thighs, and upper extremities were perfect. From this description it is pretty clear that the child was an *androgynus*, *i.e.* there was imperfect development of the sexual organs, with predominance of those of the male. There was no indication of uterus or ovaries, nor any external peculiarity, except that which is frequently met with in hermaphrodites, in which there is an arrest of male development but no intermixture of the sexes. Dr. Gross considered that, for the child's future welfare and happiness, it would be better that it should have no testicles at all, than that it should retain them under such an imperfect development of the other organs. He therefore removed them by operation from the labia or divided scrotum, and had the dissatisfaction to find that they were perfectly formed in every respect, and that the spermatic cords were quite natural. The operation was performed in July 1849, and three years subsequently (in 1852) it was found that emasculation was complete, for the disposition and habits of the being had materially changed, and were those of a girl: she was found to take great delight in sewing and housework, and she no longer indulged in riding on sticks and other boyish exercises.

The reasons assigned for the performance of this operation—namely, the entire deprivation of sex, and thereby of any sexual feelings in after-life,—appear to me to be unsatisfactory. It is clear, from Dr. Gross's description, that this being was deprived of the rights and privileges of a *male* by the removal of the testicles. (See the case of *Levi Suydam*, *ante*, p. 858.) Dr. Gross appears to have contemplated the case only in a matrimonial point of view: but in a country where the rights of citizenship and power of voting for members of Congress are much valued—where they depend on direct proofs of sex, and are so strongly contested by opposing parties,—it is a serious question whether he has not here struck a severe blow at the political rights of such beings, in thus wilfully destroying the physical evidence of the male sex! In this country it might have been a question whether he had not rendered himself liable in damages for thus tampering with the laws of nature.

Concealed sex.—It is almost superfluous to say that in some cases sex cannot be determined by the dress, appearance, or even voice of the individual. Cases in which males have passed for many years unsuspectedly as females, and *vice versâ*, have been numerous. In some instances the secret has been disclosed only by death. Facts of this kind belong rather to the annals of imposture than to those of medical jurisprudence. A somewhat singular case of this description, that of *Eliza Edwards*, occurred to me in 1833. An unclaimed body was sent to Guy's Hospital, by the inspector of anatomy, as a female: on removing the dress, however, it was found to be that of a *male!* From some suspicion respecting the cause of death, and the habits of this person, a Coroner's inquest was held. It turned out that the deceased, whose age was 24, had assumed the dress of a female at the age of 14, and had performed in many parts of England as an actress. The features had a somewhat feminine character; the hair was very long, and parted in the centre; the beard had been plucked out, and the remains of this under the chin had been concealed by a peculiar style of dress. It was remarked during life that the voice was hoarse. The breasts were like those of a male, and the male sexual organs were perfectly developed. They had evidently been subjected to great stretching, and appeared to have been drawn forward and secured to the lower part of the abdomen. The state of the rectum left no doubt of the abominable practices to which this individual had been addicted. It was found that death had taken place from natural causes. The most remarkable circumstance in the case is, that the deceased had been attended in his last illness by an eminent physician (now deceased) for disease of the lungs; and so well was the imposition maintained, that his medical attendant did not entertain a suspicion of the real sex of his patient! ('Med. and Phys. Jour.' Feb. 1833, p. 168.)

IMPOTENCY.

CHAPTER 66.

IMPOTENCY—PHYSICAL CAUSES—PROCREATIVE POWER IN THE MALE—PUBERTY—CONVICTIONS FOR RAPE—AGE FOR VIRILITY—LOSS OF VIRILE POWER BY AGE—POWERS OF CRYPSORCHIDES AND MONORCHIDES.

Definition.—Impotency is defined to be an incapacity for sexual intercourse. It may depend—1st, upon *physical*, 2ndly, upon *moral* causes. With regard to the *moral causes* of impotency they do not concern a medical jurist. Such causes are not recognized by law, and he has no duty to perform beyond the application of the principles of medicine to the purposes of the law.

Causes.—Impotency may arise from *age*,—from certain *physical causes*, *e.g.* disease,—or from congenital malformation or *defect.* With regard to *physical* causes, a distinction must be made between those which are remediable and those which are not. The presence of disease of the testicle, such as atrophy or fungous tumours, may give rise to incapacity; but the incapacity may be sometimes removed by an operation or by medical treatment, and therefore the physical cause may be removed:—in other words it is *remediable.* To such cases as these the law does not extend; but it is always expected, in alleged incapacity, that the practitioner examined on the subject should be able to say whether there is or is not a prospect of cure. Upon this point a knowledge of his profession can alone assist him; no rules can be laid down for his guidance, for there may not be two cases that will precisely resemble each other in their features. Hence it will be necessary to point out the chief causes of impotency which are of an irremediable nature, or those in which the incapacity is absolute and permanent; a point upon which a medical opinion is chiefly required.

In strictness of language, the definition of impotency, as above given, may be applied to a *female* as well as to a male; and, undoubtedly, a physical incapacity for sexual intercourse may exist in either sex. As an instance of this incapacity in the female, may be mentioned occlusion of the vagina—a condition not necessarily indicative of sterility. The mere occlusion of the vagina may be a remediable form of the malady; but its entire obliteration would be absolute and irremediable. This latter condition, however, is the only instance of complete impotency in a female. A protrusion of the uterus or of the bladder into the vagina is mentioned by some writers as a cause of physical incapacity for intercourse; but these forms of disease may commonly be remedied by art, and therefore require no further notice in this place.

In professional language, the term *impotency* has been hitherto applied exclusively to a defect in the *male* sex; and the term *sterility* is usually confined to all those conditions in the female which not only render intercourse impossible, but which render it unfruitful. A male may, however, be sterile without being impotent—a condition observed in some crypsorchides; or he may be impotent without being sterile, as where proper intercourse is prevented by reason of physical defect in the virile member, although the testicles may be in a normal condition. See on this subject, Curling on 'Sterility in Man' (1864). This author points out that sterility in the male, apart from impotency, may depend on three causes—1st, malposition of the testicles; 2ndly, obstructions in the excretory ducts; and 3rdly, impediments to the escape of the seminal fluid. A man may not be impotent, *i.e.* incapable of intercourse, but, by reason of one of the conditions above-mentioned, such intercourse would be unfruitful.

In reference to the male, the English law does not appear to go beyond the establishment of impotency from some clear and demonstrable cause, and, unless the alleged sterility were accompanied by impotency, it would take no cognizance of that condition. Further sterility from such causes could hardly be demonstrated during the life of a person—it would rest chiefly on presumption or probability.

Procreative power in the male. Puberty.—Until the period of puberty the testicles are small, and they increase very little in size in proportion to other parts. Mr. Curling found that the size of the seminal tubes differed but little at the ages of 18 months and 8 years. The sexual function in the male depends entirely on the development of these organs; but the age at which it appears differs in different persons. The age of puberty in a healthy male in this country varies from 14 to 17 years; its appearance is, however, affected by climate, constitution, and the moral circumstances under which the individual is placed: in some cases it is not fully developed until the age of 21.

The access of puberty in the male is indirectly connected with the subject of rape. A boy under the age of *fourteen years* is presumed in law to be incapable of committing a rape. (1 Hale, p. 631, and Mathew's 'Digest,' p. 57.) This presumption is probably based on the supposition that a boy at that age is impotent. The statute law, however, now merely requires proof of penetration, and rape therefore may be physically perpetrated by a boy at or even under 14 years of age. In *Reg.* v. *King* (York Winter Assizes, 1853), a boy aged 15 was convicted of rape on a girl under 10 years of age. In a case elsewhere related (see RAPE), a boy aged 19 communicated syphilis to a girl of 6 years of age. It appears that in India puberty shows itself much earlier in the male. Dr. Chevers, quoting from the 'Nizamut Adawlut Reports,' states that a boy of 13 or 14 years of age was found guilty of rape and sentenced, in consideration of his youth, to three years' imprisonment. A lad of 14 was convicted of rape on a girl of the same age; and in another case a boy only *ten years* old was convicted of rape on a girl 3 years of age! He was sentenced to a year's imprisonment. ('Med. Jur. for India,' p. 463.)

The seminal secretion in the male is not considered to be prolific until it contains those peculiar filiform bodies which are known under the name of *spermatozoa* or zoosperms. These are regarded by some physiologists as parasitic animals, but by others, with some probability, as freely moving cilia. ('Recent Advances,' Baly and Kirkes, 1848.) All agree that they are normal and essential constituents of the healthy and prolific seminal fluid. They are peculiar to the spermatic secretion, and, in healthy males, are always present in it after the age of puberty. They disappear in certain states of disease, and sometimes in advanced age: they have not been found in the undeveloped testicles of crypsorchides. In cases in which they are absent, from whatever cause, it is a fair inference that the person is impotent, or that he has lost the power of procreation. (See on this subject 'Observations on Sterility in Man,' by T. B. Curling, 1864.) In this pamphlet one case is related in which a man, æt. 42, who was married, and whose wife had borne a son then 8 years of age, had died after four days' illness from strangulated hernia. The testicles, from the fact of their being found in the inguinal canal, were examined separately by Drs. Gosselin and Godard, and no spermatozoa were discovered in either of them (p. 9). But these may have been absent at the time of examination, as the child begotten was then 8 years of age. In this long interval the secretion may have undergone a change, and have become unprolific.

The direct agency of the spermatozoon in fecundation has been investigated by the late Mr. Newport. ('Philos. Trans.' 1853, vol. 143, part 2, p. 234.) I can here only briefly allude to his researches. His experiments were performed on the amphibia, by the aid of the microscope. It would appear from these (and his inferences are fairly applicable, within certain limits, to animals and man), that the presence of spermatozoa in the seminal secretion is indispensable to the impregnation of a female,—in fact, that the fecundating power resides in these living and moving molecules. It is a curious fact, too, that active motion in the spermatozoon is essential to fecundation: thus, when they are motionless or dead, ova are not impregnated by them, and the power of impregnation is in proportion to the activity of this motion. The impotency arising from advanced age in the human subject is probably not so much owing to a deficiency of spermatozoa in the male secretion, as to their power of motion being exceedingly feeble. We learn, further, that impregnation was more certain when the quantity of spermatozoa supplied to the ovum was not reduced to a minimum: hence, whatever may be the precise quantity of the spermatic secretion necessary to effect normal impregnation, it is thus proved that a definite quantity of spermatozoa, or of spermatic influence, is required to fecundate. Exhaustion from any cause, and probably from venereal excess or self-abuse, may lead to a loss of procreative power, by reducing the number and diminishing the active motive powers of the spermatozoa. How it is that fecundation is effected by this incorporation of the spermatozoa with the ovum, it is impossible to say; but the embryo is not the product of the evolution or development of a spermatozoon. The nature of the change is a mystery which appears to be placed beyond the power of human research. The existence of sterility in the male, as well as in the female, and a want of procreative power in the sexes when the individuals are otherwise healthy, are to some extent explained by the results of Mr. Newport's researches. Without the penetration of the ovum there is no fecundation, and the conditions and circumstances which affect this result are very numerous.

In reference to the human ovum, there is an absence of that immediate contact with the male fluid which occurs in the amphibia. The human ovum may come into contact with the spermatozoa either at the ovary, in any part of the Fallopian tube, or in the cavity of the uterus; but the spermatozoa may lose their active motion before reaching the cavity of the uterus or the tube; they may not be in sufficient number, or may not meet the ovum under circumstances favourable to penetration. It is probable that the ovum may maintain its vital power in the body of the female for a considerable time after its extrusion; and although the chances of impregnation may be thereby reduced, yet fecundation may occur if all other circumstances be favourable. This would explain the occurrence of conception at any time between two menstrual periods. (See 'DATE OF CONCEPTION,' p. 815.)

Impotency from age.—It may be fairly assumed that a male is incapable of procreating until spermatozoa have appeared in the seminal secretion, and that he loses this power when they disappear. The *age* at which they are formed varies with all the causes that affect puberty. Mr. Curling has informed me that he found them in the secretion of a boy aged 18; but there is no doubt that in many cases they appear much earlier than this. This gentleman found spermatozoa in the liquid taken from the testicles of a man upwards of 70 years of age, and on one occasion in the testicles of a person aged eighty-seven. Wagner states that they are to be found in the secretions of men between 70 and 80 years of age. M. Rayer found them in the secretion of a man æt. 82 years ('Gaz. Méd.' Juin 2, 1849). Other cases of a similar kind are recorded by Debrou. ('Gaz. Hebdom.' 4th Janvier 1861, p. 6.) Facts tend to render it highly probable that the fecundating power may be retained by the male up to the age of 100. According to Dr. Duplay, the seminal fluid of old men contains spermatozoa even when they are beyond the age for fecundation ('Med. Times and Gazette,' June 4, 1853, p. 581); but he does not state the circumstances which enabled him to arrive at this conclusion. Sexual propensities are often strongly developed in children, and they may be prolific at an early age. Dr. Rüttel met with a case in which a female at the age of 14 became pregnant by a boy of the same age. (Henke's 'Zeitschrift der S. A.' 1844, p. 249.) This is the earliest age at which, so far as I can ascertain, the procreative power has appeared in the male. Dr. Hartshorne refers to an instance of extraordinary development of the male sexual organs in a child 4 years old. ('Amer. Jour. Med. Sci.' Oct. 1852, p. 561.) In a case of contested legitimacy or affiliation, this question regarding the age at which a procreative power appears in the male may have an important bearing on the issue. Thus the person may be so *young* as to render it impossible that he should be the father of a child imputed to him. Cases involving questions of legitimacy on this ground are not heard of in the present day: but in ancient law-books there are decisions relative to the illegitimacy of children born during marriage, because the alleged fathers were 7, 6, and even 3 years old! (Amos.)

The following case in reference to the affiliation of children occurred in 1840:—A woman wished to affiliate a child on a youth who was in his *sixteenth* year. The boy denied that he was the father of the child; and there was reason to suspect that the imputation had been wrongly thrown upon him in order to divert suspicion from the real offender. There was some difficulty in this case; but it appears to me that the rule for a medical man to follow on these occasions is this:—not to regard the mere *age* of the youth, whether he is above or below the average age of puberty, but to observe whether the sexual organs are fully developed, and whether there are about him any of the marks of virility, indicated by muscular development, the growth of a beard, and a change in the voice. If these signs are present, whatever may be his age, there is strong reason to suppose that the sexual functions are developed. We occasionally hear of instances of extraordinary precocity; but the development of sexual power is generally accompanied by other well-marked changes in the person. Sometimes these changes do not make their appearance until after the age of 21.

On the other hand, it may be a question at what time the procreative power disappears in a male. That impotency is one of the natural consequences of *advanced age* is undoubted; but this, as we know, forms no legal impediment to the marriage of parties, however old. The legal presumption is, that the generative faculty does not disappear through age; and if this be alleged, and legitimacy disputed on this ground, it must be satisfactorily proved by those who would benefit by the allegation. This amounts to almost an impossibility, because it is well known that there is no fixed age at which the sexual functions cease either in the male or female; and individuals, at least of the male sex, who had passed the ages of 60, 70, and even 80 years, have been known to be capable of fruitful intercourse. M. Duplay believes, from his anatomical observations on the bodies of aged persons, that the causes of impotency (sterility) in advanced age are to be found rather in the excretory than in the secretory apparatus. Thus he has met with obliterations in the canal of the epididymis, the vas deferens, and the vesiculæ, the effect of which is to prevent the accumulation and passage of the seminal fluid.

('Med. Times and Gazette,' June 28, 1856, p. 650.) Lord Erskine, in the *Banbury Peerage* claim, quoted the case of Sir Stephen Fox, who was married at 77, and had four children, the last when he was 81. Dr. Schneider met with a case in which a man of 71 had a child by his wife, who was only 17. (Henke's 'Zeitschrift,' 1842, vol. 2, p. 165.) Dr. Rüttel mentions the case of a man who, at the age of 92 years, married and had two children by his wife. When the procreative power even appears to be lost at an advanced age, the stimulus for intercourse is often very great. The same authority mentions cases in which these erotic feelings were remarked by him in reference to men between 75 and 86 years of age. (Henke's 'Zeitschrift,' 1844, p. 252.) In all cases of prolonged virility it is observed that the bodily and mental powers are also retained in an extraordinary degree, showing the close relation which exists between the sexual function and corporeal development, even to the latest period of life.

The English law on this subject was clearly laid down in the *Banbury Peerage* case, brought before the House of Lords in 1806. Lord and Lady Banbury had been married 21 years without having had issue, when his lordship died at the age of 85 years. The peerage was claimed by the descendants of an individual who called himself the son of Lord Banbury; but, in fact, it was alleged that he was the son of Lady Banbury by an adulterer, during her husband's life. According to the evidence, Lord Banbury did not appear to have been aware of his existence: and the child had always been known by another name. (Amos, 'Med. Gaz.' vol. 7, p. 741.) One of the grounds upon which the legitimacy of the descent of the claimant was contested was, that the deceased nobleman had become impotent through *age*; but it was argued, by Sir S. Romilly, that the law placed no limit on the powers and faculties of men. The assumed impotency of the husband on the ground of age, could not be admitted as a proof of the illegitimacy of the alleged offspring. In 1813 the House decided against the claim, but not on the ground of impotency from age in the husband. It was proved that Lord Banbury was hale and hearty at the time of his death; but the moral circumstances of the case, especially the *concealment* of the birth of the child from the husband, were considered to be sufficient to prove that the child through whom the claim was made was not the offspring of Lord Banbury. This case incontestably proves that there may be capacity of intercourse and possibility of access on the part of a husband, yet every species of moral evidence will be admitted to rebut the legal presumption of legitimacy when there are reasonable grounds for disputing it. Sir S. Romilly remarked, in reference to the retention of procreative power in advanced age, that the liberality of the English law on this subject was excessive; for there was no age, from *seven* upwards, at which a man had been denied the power of procreating children! (See, in reference to this subject, Henke's 'Zeitschrift der S. A.' 1842, p. 332.) Males at the age of 14, and females at the age of 12, are legally competent to contract marriage.

Impotency from local disease or accident.—The loss or destruction of the penis or testicles, either by disease, accident, or from necessary operations, would be sufficient to render a man irremediably impotent. The loss of one or both testicles, from any of these causes, would be indicated by the presence of distinct cicatrices in the scrotum. When both have been removed by operation, the person is incurably impotent; but if the organs are healthy, a sufficiency of the spermatic fluid to confer procreative powers may remain in the ducts for two or three weeks after the operation. Thus it is that animals have been known to be prolific for a certain time after castration; and one case is on record in which a man, both of whose testicles had been carried off by a gunshot, is said to have retained the power of impregnating his wife after the healing of the wound. (See a paper by Dr. Krugelstein, Henke's 'Zeitschrift,' 1842, vol. 1, pp. 348 and 352.) The loss of *one* testicle only, by accident or operation, does not render a man impotent. *Monorchides*, as they are called, have been known to be prolific. Cases of this kind must not be confounded with those in which one or both testicles have not descended into the scrotum.

In some rare instances, the testicles do not descend into the scrotum at the usual period; but one or both may remain in the abdomen, or in the inguinal canals, and only descend some time after birth; or one may be found in the scrotum, and the other remain during life in the abdomen; or both may be retained in the abdomen. In some cases of partial descent the organs have been mistaken for, and treated as, ruptures by the application of a truss! (Henke's 'Zeitschrift der S. A.' 1844, vol. 1, p. 249; Curling on 'Disease of the Testis,' 2nd ed. p. 31.) In one instance the attempt to reduce the tumour, mistaken for hernia, and the application of a truss, caused the death of the person. ('Med. Times and Gaz.' March 2, 1861, p. 240.) When one testicle only has descended, there is no ground, *cæteris paribus*, to impute impotency: the descended organ has been found healthy and to contain spermatozoa, while the retained testicle and its ducts have not been found to contain spermatozoa. Mr. Curling has collected six of these cases, of which four fell under his own observation. ('On Sterility in Man,' 1846, p. 6, and 'Med. Times and Gaz.' Feb. 23, 1861.) When neither testicle has descended, the scrotum will be found empty, without any scar indicative of a removal by operation, but the other marks of virility may still be present. These persons have been called *Crypsorchides.* It has been stated that in such cases the testicles are to be regarded as congenitally defective, and further that the individual, although capable of sexual intercourse, is incurably sterile.

The non-descent of the testicles is a state rarely seen. Mr. Marshall met with only one case of non-descent of one testicle in 1,000 recruits, and with one case of non-descent of both testicles in 10,000 recruits. There are three preparations, showing the non-descent of these organs, in the Museum of Guy's Hospital; one of them was taken from a gentleman who shot himself from despondency at his supposed defective condition. Hunter thought that the undescended testicles were always imperfect both in their structure and functions, and that crypsorchides were invariably impotent (sterile). Some recent researches have tended to support the views of Hunter. In January 1860, Mr. Partridge communicated to the Pathological Society the case of a man of 25, in whom both testicles were found in the abdomen. Several specimens of the secretion were examined, and no spermatozoa were detected. Another case was examined with a like result ('Lancet,' January 1860, p. 66), and a third by Mr. Curling ('Med. Times and Gaz.' February 23, 1861). The conclusion to which these observations have led is, that although in cases of non-descent there may be a capacity of sexual intercourse, it would not be prolific: the person will be sterile. According to this view, malposition of the organs must be taken as synonymous with defective condition: as a result of this malposition they are not capable of secreting prolific spermatic fluid, and the person is as sterile as if he had no testicles. The cases of monorchides reported by Mr. Curling (Op. cit. p. 8) to some extent support this theory, since spermatozoa were found only in the fluid of that testicle which occupied its usual position in the scrotum. He has also collected from various sources seven cases of crypsorchides, in which both testicles were either in the abdomen or in the inguinal canals; the fluid contained in them was destitute of spermatozoa, and although impotency did not exist, these persons either were or were presumed to be unprolific. M. Godard has noticed that horses whose testicles are retained in the abdomen, although capable of intercourse, are sterile.

On the other side of the question there are, however, facts which are wholly inconsistent with this theory. Many years since I published the account of two cases of crypsorchides communicated to me by my friend and colleague Mr. Cock. The testicles in these men had not descended, but their virile functions were undisputed. One of them, before he had reached the age of 30 years, had been twice married, and had had children by each wife, besides illegitimate children which were affiliated on him during the time he lived in service. In a report of cases of hernia by Mr. Poland ('Guy's Hospital Reports,' 1843, vol. 1, p. 163), there is the case of a man æt. 29, a crypsorchid, whose testicles had never descended. Mr. Poland states that there was not the slightest trace of scrotum; the penis was well-developed, and there were all the other signs of virility. This man married when he was 20: he had had two children by his first wife, and at the time of his admission into the hospital had been married two years to a second wife. In January 1862 I saw, in Guy's Hospital, a patient under Mr. Durham: the testicles of this man had not descended—they were lodged in the inguinal canals. The man was 32 years of age, well developed, with every appearance of virility about him, and with the same masculine development which is seen in other men of the same age. This man was married, and had had two children by his wife. Since puberty he had always been competent, and he ridiculed the idea that his testicles were inefficient. Another case is referred to by Mr. Curling (Op. cit. p. 9), which occurred to Dr. Debrou, of Orleans. The testicles were in the inguinal canals; there was no scrotum. The man had been married, and had had one son by his wife.

By these facts, therefore, it is incontestably established that crypsorchides are not necessarily sterile, and that no absolute rule can be laid down respecting the existence or nonexistence of prolific power under such circumstances. It has been objected that in the above instances of prolific power spermatozoa have not been proved to exist in the spermatic secretions of the individuals, and that the evidence is therefore incomplete. But these bodies have not been proved to be absent, and most persons will agree that there is no better evidence of prolific power than the procreation of children, whether spermatozoa are or are not detected—a matter which will sometimes depend on the accuracy of observation or experience of the examiners or, it may be, on a morbid state of the secretion. If none were found under these circumstances, it would only prove that our present theories of generation would require to be modified. One affirmative instance is sufficient for all the purposes of law, to overthrow ninety-nine negative instances; and as a physiological fact, it is obvious that the organs which have not descended are not always defective in structure or function. The cases hitherto observed are so nearly balanced that it is difficult to say whether it is the rule or the exception that crypsorchides should be found prolific: the facts above-mentioned clearly prove that there is no reasonable ground for pronouncing them to be absolutely sterile or unprolific merely because their testicles are not in the scrotum. If with a non-descent of these organs there should be a non-development of the other external organs, and this is accompanied by a total want of the characters of virility, then the person may be impotent or sterile. The testicles may, in such a case, be either congenitally absent or physically imperfect—a fact only ascertainable by an examination of the body after death. On the other hand, in cases in which there are no external marks of effeminacy, or other grounds for suspecting a want of procreative power, and the person is capable of sexual intercourse, this imperfection does not offer any bar to marriage, nor is it a sufficient ground for divorce. It would not justify a medical man in denying the paternity of a child on a question of affiliation, bastardy, or inheritance; and so long as the power of sexual intercourse existed, it would not justify him in pronouncing the person to be incurably sterile. The capacity for sexual intercourse is the fact to which the English law commonly looks on these occasions. If this exists, then it will hardly entertain the question—surrounded as it may be with conflicting medical opinions,—whether, from the mere retention of the organs in the abdomen, the fluid secreted is or is not, microscopically speaking, of a prolific nature? Women may be sterile from a variety of causes affecting the internal organs, only ascertainable after death. The ovaries may be so diseased that no prolific intercourse can take place, although there may be no physical incapacity. In a case related elsewhere, the incapability of *conception* on the part of a woman was held by Dr. Lushington not to be a sufficient ground for pronouncing a sentence of nullity of marriage; and doubtless the want of power to effect impregnation on the part of a male, unless it depended on some visible physical defect, would be viewed in a similar light. Such persons are not impotent but sterile, and sterility in an irremediable form is rather assumed than demonstrated to exist.

The presence of what have been called supernumerary testicles does not affect the virile powers of the individual. These have in general been found, by dissection, to be tumours connected with the healthy glands, and not at all adding to or interfering with their functions. Even the presence of two or three penes, according to Mende, is no bar to the exercise of sexual power, provided only one possesses the normal characters of the male organ. This author refers to cases of duplex organs. (‘Ausführl. Handb. d. ger. Med.,’ vol. 4, p. 337.)

In some instances there is an arrest of development in the external organs: and with this there is generally an absence of sexual desire. Mr. Farr met with a case in a man aged 42, in whom the sexual organs remained undeveloped and in an infantile state. There was some difficulty in finding the testicles, in consequence of their small size. On examining the contents of the glands microscopically, no spermatozoa were found. This person's voice was effeminate, and he was devoid of hair on the chin and pubes. (‘Med. Gaz.’ vol. 40, p. 857.) It is not, however, always to be inferred that a male with imperfectly developed organs is incurably impotent. The following case is quoted by Mr. Curling:—A gentleman, aged 26, consulted Mr. Wilson on the propriety of his entering into marriage. His penis and testicles but little exceeded in size those of a youth 8 years of age, and he had never, until this acquaintance with his intended wife, felt the desire of sexual intercourse. He married, and became the father of a family; and at the age of 28 the organs had attained the full development of those of an adult. (Op. cit. p. 95.) Under wasting of the testicle, or when the gland is extensively diseased and the sexual desire disappears, there can be no doubt of impotency. The functions of these organs are not, however, readily impaired by local disease. The spermatic secretion is still properly formed, even when only a small part of the gland remains healthy,—a fact proved by a microscopical examination. Certain diseases of the appendages of the testes may, however, render a person sterile. The spermatic secretion is commonly suspended in most severe diseases which affect the body.

A frequent cause of impotency (sterility) in the adult, when the organs are apparently sound, is spermatorrhœa, arising from abuse. This, however, is remediable to a greater or less extent by treatment. (See Curling, ‘Diseases of the Testis,’ 2nd ed. p. 386; also ‘Med. Times and Gazette,’ Jan. 23, 1858, p. 95.)

On the absence of the penis, as well as on its defective organization, as causes of incapacity, some remarks have been already made in the preceding section. Sometimes the defect is merely connected with the urethra. Thus the orifice may be on the dorsum penis, and in other cases underneath the organ, so that the urethra may terminate at a variable distance from the glans penis. Those labouring under the former defect are said to have *epispadia*, and under the latter *hypospadia*. The power to have fruitful intercourse will in either case depend on the situation of the urethral aperture. Rüttel knew an instance of an hypospadian having several children. (Henke's 'Zeitschrift,' 1844, p. 258.) Some doubt has existed respecting the virile powers of those who are affected with hypospadia. In September 1850 a lad, aged 17, was summoned before the magistrates of Kidderminster on a charge of affiliation, in reference to the pregnancy of a girl aged 18. The defence was that he could not be the father of a child, because there was such a malformation of the penis as to prevent prolific intercourse. On examination the urethra was found to terminate on the under-surface of the penis, about an inch and a half from the glans, by a small elliptical orifice, which allowed the urine to pass, but with some difficulty. One medical witness gave it as his opinion that it was not impossible, but highly improbable, that the defendant should possess procreative power; another freely admitted the boy's capacity, and the case was decided against him. ('Med. Times,' Sept. 21, 1850, p. 321.) This decision was physiologically correct. When the urine can pass the seminal fluid can pass; and the only question is, whether the intromission can be such as that the misplaced orifice should come in contact with any part of the vagina? This must depend on the situation of the orifice. [Cases illustrative of the fully prolific powers of hypospadians will be found in the 'Med. Times,' Sept. 14, 1850, p. 292; and Oct. 12, 1850, p. 392. An instance of he virility of a hypospadian has also been published by Mr. Noble, of Manchester, in the 'Assoc. Med. Jour.,' March 1853, p. 236.] Similar remarks pply to epispadians. These malformations are sometimes remediable: but whether remediable or not, they are not, under any circumstances, to be regarded as absolute causes of impotency.

The incapacity for intercourse in either sex may arise from *extensive disease* ffecting parts in and around the organs of generation. The medical opinion here must be regulated entirely by the circumstances attending each case.

Impotency from general disease.—In the preceding paragraphs the influence f local disease in affecting virility has been considered. But there is a class f cases which may come before a practitioner, in which, with well-formed organs in the male, there will be a state of impotency. Sometimes this may depend on natural weakness of constitution, or on a want of proper development of the muscular and nervous systems: at other times it is due to certain diseases, and it is then of a temporary nature—persisting while the body is still suffering from the disease, and disappearing on recovery. As a converse fact, there are certain diseases which appear to bring out the dormant irile powers of persons, or to excite to a higher degree of intensity those which already exist. Thus it is said that in convalescence from fever there is occasionally, extraordinary salaciousness: but this statement requires confirmation. Again, there are some diseases which neither interrupt nor affect the exercise of the sexual functions.

As a general rule, diseases which do not affect the brain and spinal marrow, and which are not attended with great debility, do not prevent fruitful intercourse. On the other hand, diseases which are attended or followed by great ebility suspend or destroy sexual power. Among these diseases may be mentioned water in the chest, general dropsy, especially if attended with fusion in the sexual organs,—nervous and malignant fevers which affect the brain,—apoplexy, palsy, and other diseases which directly attack the brain or spinal marrow. These last-mentioned diseases probably act by suspending the secretion or altering the nature of the prolific fluid, as well as by preventing that erection of the male organ without which intercourse cannot take place. The sexual function is so intimately allied to bodily vigour and nervous energy, that the integrity of the one may be pronounced to be essential to the integrity of the other. Habits of drunkenness and the abuse of alcoholic liquids may give rise to impotency by the injury done to the brain and nervous system. (The reader will find this subject fully discussed by Mende, 'Ausführl. Handb. der ger. Med.,' vol. 4, p. 349.)

These cases when they require to be elucidated by medical evidence create great difficulty. In *Legge* v. *Edmunds*, which came before the Vice-Chancellor's Court in 1854–5, a question arose respecting the legitimacy of a child conceived during wedlock but born four months after the death of the husband. In presumption of law, the child was legitimate, because husband and wife were at the time living together, and conception and birth were, as to date, in accordance with the ordinary rules. Two months preceding the supposed date of conception, the husband, a man of intemperate habits, was seized with paralysis (*hemiplegia*) accompanied by coma, and he lost the use of the right side of his body. In about a month he partially recovered, but the paralysis never left him. A month later he was attacked with general dropsy and disease of the liver; and he died five months after the supposed date of conception, and four months before the birth of the child. A year after the death of the husband, the widow married the defendant, the alleged adulterer, and had by him four children; but for eight years preceding the death of her first husband this woman had borne no child, and it was only when her intimacy with the alleged adulterer commenced, and during her husband's illness, that she became pregnant. The question submitted to Dr. Carpenter and myself on this state of facts was—Was it possible or probable that the husband could have begotten the child in the diseased condition in which he was represented to have been at the date of conception? The opinion given was that it was possible, because there was opportunity of access; and sexual power, if lost by the attack of paralysis, might have returned at a time corresponding to this date; but we considered it to be in the highest degree improbable. It was alleged that diseases of this kind tended to suspend sexual power, that in this particular instance the effect would be aggravated by the intemperate habits of the husband, and the general exhaustion and debility under which he was labouring. Further, the non-procreation of children during the eight years that he was married and in habits of intercourse with his wife, was clearly not owing to sterility or incapacity on her part, because she had borne four children after her marriage with the defendant: it could therefore, in our opinion, be assigned only to impotency or incapacity in her first husband.

The general conclusion which we drew from the facts laid before us was, that the husband at the time was impotent, and incapable of begetting a child. Evidence to this effect was given by us in the enquiry subsequently directed by the Vice-Chancellor. At the same time, we did not feel justified in asserting that prolific intercourse on the part of the husband was actually impossible. Dr. Guy and Dr. Semple gave evidence on the part of the defendants, to the effect that there was no proof of impotency in the husband, and that a man labouring under such an illness as that from which he was stated to have suffered, would still be physically capable of procreating children. The evidence regarding the precise bodily condition of the husband about the date of conception was conflicting: and on this ground probably, as well as in conformity with the legal rule that a child begotten in wedlock is to be regarded as the child of the husband—unless an *impossibility* of access or intercourse is proved—the Vice-Chancellor decided in favour of the defendants, that the child was the child of the husband, and was entitled to the estate which the plaintiffs, the heirs of the husband, sought to recover from the defendant and the widow who had married him. There was no evidence from parental likeness, for the child through whom the claim arose had died some time before proceedings were taken. Without disputing the equity of this decision, it involves this assumption — that during eight years of a dissipated life, and before being attacked by paralysis (hemiplegia), the husband did not possess procreative power, and that this only manifested itself suddenly, after a severe attack of the disease from which he never entirely recovered. The legal presumption of legitimacy by wedlock and possible access was, however, too strong to be rebutted by medical opinions.

Mr. Curling observes that diseases and injuries of the spinal cord producing paraplegia have no direct effect on the testicles, but destroy the power to copulate. (Op. cit. p. 371.) When there is a wasting of the testicles, as a result of general paralysis of long standing, there can be no doubt of impotency; but Mr. Curling quotes a case from a foreign writer, in which, under paralysis (paraplegia) of some years' duration, a man retained sufficient sexual power to have prolific intercourse. When the paralytic person is advanced in age, it is highly probable that he is impotent. In December 1857 a case was referred to me, in a question of bastardy, for my opinion on the capacity for intercourse under the following circumstances. A woman required an order of affiliation on the putative father of her bastard child. She was a widow, and the illicit connection took place about two months before her husband's death. The husband was at the time 84 years of age; he was bedridden, and for many weeks before his death he could not move in his bed, and was unable to pass his urine without assistance. The medical opinion of those who examined him was that he was impotent from physicial infirmity, and in this opinion I concurred; stating, however, that unless the male organs were diseased or destroyed, it could not be said that intercourse was impossible. It was, however, wholly improbable that the husband could have been the father of the child.

Some diseases appear to have a specific influence on the development of the sexual organs: and although not influencing the nervous system—not affecting the sexual organs directly, nor leaving any trace of constitutional disturbance —they lead to an arrest of sexual development, and therefore to impotency and sterility. One disease has been especially noticed as possessing this influence—namely, *cynanche parotidea,* or mumps. Sir Astley Cooper was accustomed to state in his lectures that on the subsidence of this disease, when it attacked adolescent males and females, the testicles in the male and the breasts in the female became occasionally inflamed. The organs shrank, and slowly withered; their development was arrested, and in the male incurable impotency was the result. Dr. Krugelstein refers to a case in which a strong and healthy man was rendered incurably impotent after an attack of this disease. (Henke's 'Zeitschrift,' 1842, vol. 2, p. 354: see also Curling, op. cit., p. 59.) On the withering of the testicles from disease, see a paper by Dr. Albers of Bonn, Casper's 'Wochenschrift,' Sept. 1851, pp. 568, 577.

Blows on the head or spine, by affecting the brain and spinal marrow, may produce impotency. Several cases of impotency from this cause are related by Curling (op. cit. p. 362). It has been noticed that blows on the under and back part of the head, in the region of the cerebellum, have been followed by loss of sexual power on recovery. Sometimes this is temporary; but at other times, when there is wasting of the testicles, it is permanent and irremediable.

Of *moral* causes it is unnecessary to speak. The sexual desire, like other animal passions, is subject to great variation; and there are instances on record in which men, otherwise healthy-looking and healthily formed, have experienced no desires of this kind. They are in a state of natural impotency—

a condition which the Canon Law designates as frigidity of constitution. This is not to be discovered by examination, but rather from their own admission. Under this head we may class hypochondriacal affections. [For a valuable scientific summary of the causes and treatment of impotency, I must refer the reader to the work of Mr. Curling, 'Diseases of the Testis,' 2nd ed., p. 359, 1856.]

STERILITY.

CHAPTER 67.

STERILITY—CAUSES—PROCREATIVE POWER IN THE FEMALE—PUBERTY—EARLIEST AND LATEST AGES FOR CHILD-BEARING—FEMALE PRECOCITY—AGE FOR CESSATION OF THE MENSES—LEGAL RELATIONS OF IMPOTENCY AND STERILITY—LEGITIMACY AND DIVORCE.

Definition.—Sterility is usually defined to be 'the inability to procreate, or a want of aptitude in the female for impregnation.' It is not usual to speak of sterility in the male, although there may be procreative incapacity; because the defective condition in this sex, from whatever cause, is, in a legal view, included under the term 'impotency' (see p. 861, *ante*). In the strictness of language, a male who has been castrated is sterile; but it is commonly said that he is impotent. Many apparently well-formed males may be sterile without being impotent, *i. e.* they may have intercourse without procreating; for the power of copulating must not be confounded with that of procreation. Mr. Curling has pointed out that various causes may render a male sterile, although he may retain a power of sexual intercourse, and thus cannot be regarded as impotent in a legal sense. ('Diseases of the Testis,' ed. 2, p. 216.) Some crypsorchides may be sterile, or deficient in procreating power, while at the same time impotency or incapacity of intercourse may not exist. In reference to women, sterility implies that condition in which there is an 'inability to conceive.' This appears to be the true meaning of the term, and the sense in which it is used not only by the best writers but in common phraseology.

Procreative power in the female. Puberty.—In the *female*, the procreative power is supposed not to exist until after the commencement of menstruation, and to cease upon the cessation of this periodical secretion. The menstrual function is commonly established in females in this climate between the ages of *fourteen* and *sixteen*; but it may occur much earlier—indeed, in some rare instances, a discharge resembling the menstrual has been known to occur in mere infants. In other cases its appearance has been protracted to a much later period. According to Dr. Rüttel, the menstrual function appears in the smallest number of females at 12, 13, and 14, and in the largest number at 16, 17, and 18 years. In some it is only first established at from 19 to 21 years; and he states that at this age he has often found the uterus small and quite undeveloped. The earliest and latêst period in a large number of cases were respectively 9 and 23 years. ('Lancet,' Nov. 30, 1844, p. 283.) Perhaps, in this country, the most frequent age for the commencement of menstruation may be taken at 15 years. It is liable to be accelerated in its appearance by certain moral and physical conditions under which a girl may be placed. According to Dr. Chevers, women in India begin to menstruate after the twelfth year or at the beginning of the thirteenth, and the function continues until the fortieth or even the forty-fifth year. Menstruation at ten years is very uncommon, and probably does not occur in more than one or two instances out of a hundred females. It is equally rare that it should be delayed beyond the thirteenth year. ('Medical Jurisprudence for India,' 1856, p. 461.) The most common intervals for the appearance of this function are twenty-eight and twenty-one days. It is sometimes late in life before it appears. Dr. Camps found that it had not appeared in a married woman, æt. 30, who had borne no children. ('Med. Gaz.' vol. 32, p. 409.) Another case is mentioned in the same volume where it appeared for the first time at the age of 47 (p. 567). So soon as this function commences, a woman may be considered to have acquired procreative power; but a female may conceive before the function has commenced, during the time of its occurrence, or after it has ceased. From facts elsewhere stated (*ante*, p. 815) there is some reason to believe that the period which immediately precedes or follows the discharge is favourable to conception: although the experience of most accoucheurs has now proved that impregnation may take place at any time between one menstruation and another.

It is important to remember that these changes in the uterus may produce remarkable effects by sympathy with the brain and nervous system. At or about the time of puberty, especially if any cause of obstruction exist, females become irritable, easily excited, and they have been known to perpetrate, without motive, crimes of great enormity, such as murder and arson. A propensity to steal is also stated sometimes to manifest itself. (See *post*, KLEPTOMANIA.) It has been remarked that acts of arson have been frequently committed by girls at this period of life, and the crime has spread by imitation. The case of *Brixey*, tried for the murder of an infant, and acquitted on the ground of insanity, will serve as an illustration of the morbid effect produced on the brain by disordered menstruation. (See *post*, INSANITY.) The state of the mind should be therefore carefully watched at this period of life, and any causes of violent excitement removed. Irregularity, difficulty, or suppression of the menstrual secretion may give rise to temporary insanity. Puberty in the *male* may be attended with similar morbid propensities, but these are not so commonly witnessed as in the female sex.

Pregnancy before menstruation.—The occurrence of menstruation is not indispensable to pregnancy: many cases are on record in which women who had never menstruated have conceived and borne children. One case is reported in which a female, aged 25, became pregnant and bore a child, and menstruation was only regularly established afterwards. ('Lancet,' February 1842.) Dr Murphy mentions another instance of pregnancy previous to menstruation in a woman aged 23. ('Obstetric Reports,' 1844, p. 7.) Numerous cases of conception without previous menstruation are quoted by Capuron ('Méd. Lég. des Acc.' p. 96); and no fewer than nine instances of pregnancy before menstruation have been collected by Mr. Whitehead. The females were all in excellent health during the whole time, and one did not menstruate until more than two years after the marriage had been consummated. ('On Abortion,' p. 223; see also Orfila, 'Méd. Lég.' 1848, vol. 1, p. 257.) Another case will be found reported in the 'Medical Gazette' (vol. 44, p. 969). Dr. W. Taylor met with an instance in which a female aged 13 bore a child before menstruation had appeared. ('Med. Times and Gazette,' March 12, 1853, p. 277; see also, for remarks on this subject, 'Edin. Monthly Jour.' July 1850, p. 73.) The late Dr. Reid has stated that a patient of his bore a child at the age of 17 without having previously menstruated; and he collected from various authorities a number of cases of pregnancy occurring in women who had not menstruated. ('Lancet,' September 3, 1853, p. 296.)

According to Bischoff, the uterine discharge of blood in menstruation is only a symptomatic although a usual appearance. But it may be absent, while the ovarian changes go on in the usual way: hence a non-menstruating woman may conceive. At the menstrual period the uterus undergoes certain changes; the mucous membrane is swollen, and the uterine glands are strongly developed: hence the expelled ovum finds a ready spot of attachment when impregnated, and an absence of this swollen condition of the mucous membrane at other times may be one cause of sterility. From an inspection of the generative organs in the human female, in thirteen cases, during or shortly after menstruation, he inferred that the change in the uterine mucous membrane was synchronous with the commencement of menstruation: this condition was observed to remain for so long a period as eighteen days after the function had ceased. The true function of menstruation appears to be the ripening and separation of the ovum. ('Medical Times and Gazette,' April 8, 1854, p. 354.)

Instances of *premature puberty* in the female are now numerous: they are far more common than in the male sex. Mr. Whitmore met with the case of a female child who, from a *few days* after birth, menstruated regularly, at periods of three weeks and two or three days, until she had attained the age of 4 years, when she died. On inspection after death she appeared like a much older girl. The breasts were unusually large, and the female organs and lower limbs were considerably developed. ('North. Jour. Med.' July 1845, p. 70.) Another case is reported in the 'Lancet' (January 29, 1848, p. 137); this was a child aged 3 years. The breasts were as healthily developed as in an adult of 20 years, and the sexual organs were also as much developed as in a girl at the age of puberty. It was observed that this child, who had been regularly menstruating for twelve months, had the appearance of a little old woman. (For other cases of menstruation at 5 years, see 'Med. Gaz.' vol. 25, p. 548; at 3 years, vol. 47, p. 244; and at 3½ years, 'Med. Times and Gazette,' July 24, 1858.) In these instances there is great reason to believe that procreative powers are early developed; but it is not common to hear of such young females becoming impregnated. A case is mentioned by Dr. Beck, in which a girl menstruated at one year; she became pregnant, and was delivered of a child when little more than *ten years* old. Dr. Walker met with a case in which the menstrual function was established at the age of 11½ years, and the patient was delivered of a living child when only 12 years and 8 months old. ('Amer. Jour. Med. Sci.' October 1846, p. 547.) In another, observed by Rüttel, already referred to, a female of the age of *fourteen* became pregnant by a boy of the same age. He also quotes three other cases, where one girl of the age of *nine*, and two of the age of *thirteen*, became pregnant (loc. cit.). The first of these three cases represents the earliest age for pregnancy yet assigned by any author. Dr. Wilson met with an instance in which a girl at the age of 13 years and 6 months gave birth to a full-grown child; conception must have taken place when she was 12 years and 9 months old. ('Edin. Med. Jour.' October 1861. See also Casper's 'Vierteljahrschrift,' January 1863, p. 180.) Mr. Robertson mentions the case of a factory-girl who became pregnant in the eleventh year of her age.

I am indebted to Sir Eardley Wilmot for the particulars of a case (*Reg.* v. *Chattaway*) which was the subject of a trial on the Midland Circuit. At the Coventry Summer Assizes, in 1848, he conducted a prosecution against a man, æt. 45, for a misdemeanor in having had carnal knowledge of a girl named *Sprason*, then between the ages of ten and twelve years. When intercourse was first had, the girl was *eleven years and eight months old*; it was repeated several times subsequently: and when the prosecutrix gave her evidence in Court, it appeared from the statement of the mother that she was in the last month of her pregnancy: she was then not quite twelve years and six months old. Sir E. Wilmot ascertained by inquiry that menstruation had commenced in this girl at the age of *ten years and two months*, and had continued regularly up to December 1847, which was about the time when she had first had intercourse with the prisoner. It appeared that she was a factory-girl; and to the heat, confinement, and association with males, to which girls are subjected in this employment, may be referred the early commencement of puberty. When menstruation has thus commenced, conception may always be the result of sexual intercourse. The prisoner was convicted, and sentenced to two years' imprisonment with hard labour. The reader will find some additional particulars, in reference to this case, by Mr. Smith, of Coventry. ('Med. Gaz.' vol. 42, page 751.)

Age at which menstruation ceases. Menstrual climacteric.—The average age at which this function ceases in woman is usually from forty to fifty years: but as it may commence early, so it may continue late in life. In one case it has been known to cease at the age of 23, and in other instances it has continued to the age of 66 and even of 75 years. (Whitehead, op. cit. p. 145 et seq.) Dr. Royle describes three cases, in two of which menstruation continued up to the age of 67. ('Med. Times and Gaz.' Nov. 1860.) Mr. Thomas met with a case in which a woman had ceased to menstruate at the age of forty-five, but the discharge suddenly reappeared after an attack of illness when she had reached the age of sixty-nine. The discharge appeared several times, but not with monthly periodicity. It seems that her mother and sister had also menstruated at the ages of 69 and 60. ('Med. Times and Gaz.' Aug. 7, 1852, p. 148.) In a case which occurred to Capuron, it continued beyond the age of 60 (op. cit. p. 98); but a more remarkable case, both of late menstruation and late pregnancy, is quoted by Orfila from Bernstein. A woman, in whom the function appeared at 20, menstruated until her ninety-ninth year. Her first child was born when she was 47, and her seventh and last when she was 60. ('Méd. Lég.' 4ème éd. 1848. vol. 1, p. 257; see also Briand, 'Man. Complet de Méd. Lég.' 1846, p. 137.) From these facts, it is clear that it is impossible to fix the age of a woman by the period at which this 'change of life' occurs. At the best, it can only be an average of a certain number of instances. This question arose in the case of *Clark* v. *Tatom* (Kingston Lent Assizes, 1848), in reference to the identity of a woman, through whom property was claimed by the husband who was the plaintiff in the action. The marriage had taken place in 1794—the parties separated in 1809; and the plaintiff's wife, as it was alleged, died in 1843, when, by direction of the defendant, the age of 55 was put upon the lid of her coffin. A medical gentleman, who attended her in 1841, deposed that, from being then in her menstrual climacteric, he should consider her not to have been more than 50 at that time. He stated that the *general* period for the cessation of menstruation was 44; it was rarely protracted to the age of 50. On this assumption, it was impossible that the deceased could have been the plaintiff's wife, because at the time of the alleged marriage she would have been only *three years old!* On the part of the plaintiff, direct evidence was given to show that the deceased woman was his wife; and it therefore remains to be considered whether the adverse medical opinion is or is not consistent with medical experience. It is obvious, from the cases above quoted, that menstruation may continue to 66 or 70 years of age, and that this may have been an exceptional instance. The plaintiff had a clear right to this medical presumption in his favour; and, admitting that his wife was seventeen at her marriage, she would have been menstruating in her sixty-sixth year. Hence it is evident that the medical facts of the case were consistent with the evidence adduced on the part of the plaintiff. At the trial those well-known exceptional cases of menstruation beyond the fiftieth year were not even referred to: nevertheless the jury returned a verdict in favour of the plaintiff.

Is it possible for a woman to become pregnant after menstruation has ceased?—It is commonly asserted and believed that, after the cessation of menstruation, a woman is sterile. This is doubtless the general rule; but in a medico-legal view it is necessary to take notice of the exceptions. Mr. Pearson, of Staleybridge, communicated to the 'Lancet,' some years ago, the case of a lady, aged 44, who up to September 1836 had given birth to nine children. After this the menses appeared only slightly at the regular periods until July 1838, when they entirely ceased. Owing to this, she supposed that she was not liable to become pregnant; but on the 31st December 1839—therefore eighteen months after the entire cessation of the menses—she was delivered of her tenth child. Hence conception must have taken place at from eight to nine months after the final cessation of the discharge.

Latest age for pregnancy. Fecundity.—Dr. Duncan concludes, from his researches, that the great majority of the population is recruited from women under 30, but that the mass of women of from 30 to 40 years contribute to the general fertility a larger proportional share than the mass of women from 20 to 30. There is a gradually increasing fecundity as age advances up to about 25, and then diminishes. ('Edin. Monthly Journal,' Nov. 1864, p. 450.) The age at which women cease to bear children is usually from 40 to 50 years; but as they may menstruate, so they may conceive, beyond the last of these periods. Besides, the facts above-mentioned show that the continuance of menstruation is not absolutely necessary for conception. Numerous instances are on record of females advanced in life bearing children. A case is reported in which a well-formed woman, who had been married nineteen years, did not bear a child until she had reached the age of *fifty*. (Schmidt's 'Jahrbücher d. Med.' 1838, S. 65; Henke's 'Zeitschrift,' 1844, S. 251.) In this case it is stated that menstruation had ceased two years before conception. Rüttel observed in twelve women that they bore their last children at ages varying from 45 to 50 years. Ottinger met with an instance of a woman bearing a child at 50; Cederschjald with another, where the woman was *fifty-three*, and menstruation still continued. Haller records two cases in which women at *sixty-three* and *seventy* respectively bore children. (Briand, 'Man. Complet de Méd. Lég.' p. 137.) Nevermann has drawn up a table in reference to the late ages of life in which women have borne children. Out of 1000 cases in 10,000 births, he found that 436 children were borne by females at the ages respectively—

Of 41 years	101	Of 48 years	8
42	113	49	6
43	70	50	9
44	58	52	1
45	43	53	1
46	12	54	1
47	13		

A case was communicated to the 'Medical Gazette' (vol. 39, p. 950) by Dr. Davies of Hertford, in which a woman was *fifty-five* years of age when her last child was born: she menstruated up to that time. In *Lord* v. *Colvin* (Vice-Chancellor's Court, July 1859), one of the questions raised was whether a woman æt. 52, who had been married thirty years without having children, had then passed the age of child-bearing: her issue would take the benefit of certain property under a will. It was decided that the female had not reached an age at which it could be said to be impossible that she might bear children. In a return of the Registrar-General for Scotland (Feb. 1862), it is stated in the Table for Glasgow, that one mother who was only 18 had had four children, one who was 22 had had seven children, and of two who were only 34 the one had had thirteen and the other fourteen children. On the other hand, two women became mothers as late in life as at 51, four at 52, and one mother was registered as having given birth to a child in the 57th year of her age.

We cannot pretend to fix the age beyond which pregnancy cannot occur. Questions of this kind have an important bearing on the subject of legitimacy; and unless the law looks to something more than ordinary professional experience in such matters, the decisions of Courts must be inequitable. The legitimacy of the claimant of the Douglas Peerage, about the middle of the last century (*ante*, p. 841) was contested, among other grounds, on the presumed loss of procreative power in the woman said to be the mother, who was in the fiftieth year of her age at the time of the alleged birth, and who therefore must have conceived when in her *forty-ninth year*. Lords Camden and Mansfield justly decided that this was no objection to the legitimacy of the appellant. The fallacy of trusting to a ground of this kind as evidence of illegitimacy is proved by a reference to the numerous cases already quoted. A case somewhat similar was the subject of a trial in France in 1754. *François Fajat* claimed an estate as heir to his mother. His claim was resisted on the ground that, according to the baptismal registry, his mother could not have been the legitimate heiress of the party through whom the claim accrued; because her alleged mother would then have been in her *fifty-eighth* year; and this, it was alleged, was beyond the age of child-bearing. Ancient records were searched, and the claim of legitimacy was admitted, because menstruation and conception had been known to occur at periods of life even later than this. (Capuron, 'Méd. Lég. des Accouch.' p. 93.) This author quotes a case in which a healthy woman menstruated until she had passed her *sixtieth year*, and her last child was born when she was *sixty years* of age (p. 98). Other cases of births at the respective ages of 63 and 65 are referred to, but these appear to be of a less authentic kind. The truth is, in giving a decision, the law is bound to look to the anomalies connected with the exercise of the generative function; and therefore the limited experience of a few witnesses casually taken, can hardly be expected to supply satisfactory answers to questions of this kind. It establishes no presumptions respecting the presence or absence of child-bearing power at any period of life; it leaves each case to rest upon the whole of the circumstances which attend it.

Causes of sterility.—The causes of sterility in the female system are very numerous. Some of them depend upon peculiarities of constitution, the sexual organs being well-formed and developed,—others upon latent changes or congenital defects in the uterus and its appendages, only discoverable by an examination after death. Sterility rarely becomes a medical question in contested cases of legitimacy; for a claim on the part of a person to be the offspring of a particular woman, unless she were in collusion with the claimant, could only be made after her death; and if not disproved by medical evidence, showing that the woman could not have borne children, it would in general be easily set aside by circumstances. If the uterus, ovaries, or other parts were congenitally defective or absent, or if there were external sexual malformation, accompanied by occlusion or obliteration of the vagina, a medical witness could have no difficulty in saying that a woman must have been sterile. (See 'Med. Times and Gazette,' Jan. 23, 1858, p. 96.) A mere occlusion of the vagina, removable by operation, does not necessarily indicate sterility, for the internal parts may be healthy and sound. In some instances the ovaries or the uterus may be entirely absent, or the Fallopian tubes may be obliterated,—conditions which cannot in all cases be determined during life; in other instances these organs may exist, but be defectively developed. Dr. Coley relates a case in which, in the body of a woman æt. 26, the uterus was found not larger than in an infant of one or two years of age. The mouth and neck of the uterus were perfectly defined, but were not larger than a crowquill in diameter, and one of the ovaries was imperfect. The patient had, on a few occasions, observed an appearance resembling menstruation. ('Obstet. Record,' May 1848, p. 169.) The absence of a uterus, and the absence of the function of menstruation, do not necessarily prevent the development of strong sexual propensities, although there is of course incurable sterility. (See case in 'Assoc. Med. Jour.' July 29, 1853, p. 672.)

Some of the physical causes of sterility in a woman are removable by art. Thus, when the vagina is unnaturally closed, this condition may be often remedied by operation. An instance of this kind is related by Mr. Dumville ('Medical Gazette,' vol. 40, p. 1116), in which a female subsequently married and bore a child. It is a fact worthy of notice, that if the internal organs are in their normal condition, the slightest aperture will suffice for impregnation. Penetration is not necessary. Women have thus been known to conceive under circumstances which appeared quite adverse to the possibility of conception; and when they had arrived at the full time, it has been found necessary to make a free incision into the parts which resisted the passage of the child's head. A remarkable case of this kind, which occurred to Dr. Simmons, is quoted in the 'Lancet' (June 19, 1847, p. 651), and there are many others of a similar nature on record. Sometimes the external passage is free, but the occlusion may be at the mouth of the uterus. This is a cause of sterility which, however, admits of remedy by operation. Cases of this kind have been successfully treated by my colleague Dr. Oldham ('Med. Gaz.' vol. 38, p. 919), and by other obstetric practitioners.

An absence of the menstrual function (amenorrhœa) has been described as a cause of sterility; but several cases have been already mentioned, which show that women who have never menstruated, or in whom the discharge has appeared and has ceased for many years, and who are otherwise healthy and well-formed, may become impregnated. When, however, the absence of menstruation depends on a closure of the mouth of the uterus, or other physical causes of the like nature, there will of course be sterility. If in other respects a woman is well-formed, she cannot be regarded as in a necessarily incurable condition. Dr. Oldham has published two cases in which the women had each attained the age of 48 years without having menstruated. ('Med. Times and Gaz.' March 27, 1852, p. 311.) There was general good health, with a proper development of the sexual organs, in both. An inordinate periodical discharge (menorrhagia), depending on uterine disease, or disturbed and difficult menstruation (dysmenorrhœa), are frequent causes of sterility. The deranged health which accompanies these morbid conditions may be, however, itself unfavourable to conception. Difficult menstruation frequently depends on stricture of the neck of the uterus. Sterility arising from this and other diseased states of the menstrual function admits of remedial treatment. Mr. Brown has noticed that prolapsus ani, fissure of the rectum, and other diseases affecting this bowel, as well as the presence of worms therein, may be causes of temporary sterility. ('Med. Times and Gaz.' Feb. 21, 1857, p. 186.)

Dr. Hicks informs me that he has observed that women who have not menstruated before marriage have conceived immediately after their marriage. Instances are well known to occur in which a woman has not menstruated for some months previous to conception, and thus gestation has appeared to be considerably protracted. Hence a woman may conceive, although menstruation has not commenced—and although it may have commenced and afterwards ceased.

There is a popular notion that women during menstruation and lactation are sterile; but this is incorrect. (Henke's 'Zeitschrift,' 1844, p. 263.) *Leucorrhœa*, or that morbid state of the uterus and vagina which accompanies this disease, is commonly set down as a cause of sterility; but it is well known that women who have for years suffered from leucorrhœal discharge, have conceived and borne children. M. Donné thinks that this fact is explicable on chemical principles. He has observed that the spermatozoa on which fecundation depends live and are active in the vaginal secretion on some occasions, while their movements are at other times speedily arrested. In the latter case, he has found the mucus strongly acid, and he considers that this may act noxiously and destroy them. The uterine mucus is alkaline, and in general the spermatozoa are unaffected by it: in cases, however, in which it was strongly alkaline, their motions were also destroyed. ('Cours de Microscopie,' p. 330.) Further observations are required before this theory can be admitted. The physiology of conception, as to the precise time and circumstances under which it occurs, is altogether a mystery (*ante*, p. 815). Well-organized and healthy women remain sometimes married for years without bearing children: when, without any apparent change of habit, they become impregnated, even after a barrenness of fifteen or twenty years. Any diseased condition of the system is unfavourable to impregnation, and *à fortiori* diseases affecting the uterus or ovaries. A common cause of sterility is inflammation of the ovaries, Fallopian tubes, &c., whereby either the Graafian follicles are destroyed, so far as their power of ovulation is concerned, or the Fallopian tubes are so injured or tied down by adhesions as to prevent them from acting as oviducts. The causes of this inflammation are numerous—as, acute suppression of the menses, gonorrhœa, miscarriage, parturition, &c. It will be proper to ascertain if at any time the sterile woman has had inflammation in the pelvic region or, as it is often called, in the 'lower bowels.' A careful examination *per vaginam* would frequently show the uterus drawn to one side, or more or less fixed. Of all diseases affecting the uterus, chronic endo-uteritis, or what may be called 'irritable uterus,' is, in Mr. Whitehead's opinion, one of the most frequent causes of sterility. ('On Abortion,' p. 400.) This view is also supported by Dr. W. Cumming, of Edinburgh. His observations tend to show that a diseased state of the lining-membrane of the uterus is a frequent cause of temporary sterility, but it may be removed by proper treatment. ('Lancet,' May 12, 1855, p. 480.) Change of air and climate has in some instances alone sufficed to remove sterility, probably by relieving a diseased condition of the generative organs. It has been remarked, too, of males and females, that there has often been a return of procreative power after recovery from an attack of fever. On the whole, the physical and irremediable causes of sterility in the female, are not so apparent as in the male, because in the former the generative apparatus is placed internally, and slight changes in its various parts sufficient to produce permanent sterility, cannot be determined by an examination during life.

Medico-Legal relations of the subject. Divorce.—Sexual malformation, involving impotency or sterility, constitutes one of the *canonical* impediments to marriage, and if matrimony be contracted by a party labouring under such malformation, the contract is voidable. Canonists have reckoned fourteen impediments to matrimony, enumerated in the following quaint hexameters (Poynter's 'Doctrine,' p. 84):—

'Error, conditio, votum, cognatio, crimen,
Cultûs disparitas, vis, ordo, ligamen, honestas,
Si sis affinis, si forte coire nequibis,
Si parochi et duplicis desit præsentia testis,
Raptave sit mulier, parti nec reddita tutæ,
Hæc facienda vetant connubia, facta retractant.'

In the marriage-contract there is implied a capability of consummation, so that an incapacity in either party in this respect, constitutes a legal ground for annulling the agreement: 'Vir et mulier si se conjunxerint, si postea dixerit mulier de viro quod non possit coire cum eo, si potest (per verum indicium) probare quod verum sit, accipiat alium (Caus. 23). Quia matrimonium ordinatum fuit non solum ad evitandam fornicationem, sed etiam ad proles procreandas: si matrimonium (tale quale) fuerit inter virum et mulierem de facto solemnizatum, qui omnino inhabiles sunt, *non propter ætatem*, sed propter aliquod naturale impedimentum ad proles suscitandas, utpote propter impotentiam et frigiditatem, maleficentiam, et similia, quæ ipso jure reddant hujusmodi matrimonium nullum. Hæc impedimenta naturalia aliquando contingunt tam in muliere quam in viro et pars gravata agere potest in causâ nullitatis matrimonii.' ('Oughton,' tit. 193, sec. 17.) As to presumed incapacity from *age*, the law takes no cognizance of it. The Pappian law of the reign of Tiberius forbade women under 50 to marry men of 60, and *vice versâ*, but it is now known that females are prolific beyond 50, and males beyond 60.

The impediment constituting impotency may arise either from malformation, from that which the law calls frigidity of constitution, or any physical cause of whatever nature which may render intercourse impossible. When the physical defect is not apparent and irremediable, a continued cohabitation of three years is required before a suit can be entertained (Ayliff's 'Parergon'); but according to Oughton—'hæc triennalis expectatio non est necessaria ubi statim possit constare de impotentiâ coeundi.' Suit for a sentence of nullity may be promoted by either party, and the medical proof required to found a sentence, must be such as to satisfy the Court that the incapacity pleaded was in existence at the time of the marriage, and that it still remained without remedy. There should be no delay in instituting the suit, and there should be proof that the impediment was not known to the complaining party at the time of the contract. A longer delay in making the complaint is allowed to a female, without prejudicing her case, than to a male, by reason of the modesty of her sex. In a suit which came before the Ecclesiastical Courts in 1845, a singular question arose whether, when there was a capacity for sexual intercourse on the part of a woman, with a certainty that from physical defect it could never be prolific, this was sufficient to entitle the husband to a divorce. The female was examined by Drs. Bird, Lever, and Cape; and they reported that the sexual organs were undeveloped, like those of girls who had not reached puberty, that the vagina was only three-quarters of an inch in depth, and that there was no uterus. They stated that sexual intercourse might take place in an imperfect way, but that conception could not result. On a second examination, seven months afterwards, it was found that the vagina had become elongated, and had then a depth of two inches; but there were no medical means of improving its condition or of removing the defect. It was contended for the husband that the defect was natural and irremediable, and that he was entitled to a sentence of nullity of marriage. On the part of the wife, it was insisted that, in order to entitle a party to this sentence, there must be an *utter impossibility* of sexual intercourse. The case, it was argued, was one of mere sterility, which was no ground for a sentence: actual consummation had taken place. Dr. Lushington, in pronouncing judgment, said, that mere incapability of *conception* is not a sufficient ground whereon to found a decree of nullity. The only question is, whether a female is or is not capable of sexual intercourse; or, if at present incapacitated, whether that incapacity admits of removal? A power of sexual intercourse is necessary to constitute the marriage-bond; and this intercourse must be ordinary and complete, not partial and imperfect; yet it would not be proper to say that every degree of imperfection would deprive it of its natural character. If it be so imperfect as to be scarcely natural, it is, legally speaking, no intercourse at all. As to conception, there is no doubt that the malformation is incurable. If there was a reasonable probability that the female could be made capable of natural coitus, the marriage could not be pronounced void: if she could not be made capable of more than an incipient, imperfect, and unnatural coitus, then it would be void. Dr. Cape stated that under present circumstances there could be only a restricted and limited connection: it could not be called perfect and complete. The vagina might possibly become a little more elongated, but this would expose the female to danger. From these facts the marriage was pronounced null and void. (See 'American Journal of Med. Sci.' Jan. 1848, 305.) Hence we may infer, that if the vagina had been of its natural length, notwithstanding the absence of the uterus, and the impossibility of conception, a sentence of nullity would not have been pronounced. This is rather conflicting with the doctrine, that the main object of a marriage, valid in law, is *ad proles procreandas*.

The nature of the medical evidence required on these occasions will be best understood by the following extract from Oughton:—'Ad probandum defectus judex compellere potest virum ad exhibendum præsentiam suam et ad ostendendum in aliquo loco secreto (per judicem assignando) pudenda sua, seu illos corporis defectus quos mulier objicit (si ex inspectione corporis apparere possint), medicis et chirurgis peritis prius judicialiter in præsentiâ de diligenter inspiciendo virum et de referendo in scriptis eorum judicium uratis. Et si medicorum et chirurgorum judicium sit quod morbus vel defectus viri fuerit insanabilis et incurabilis (tamen tenentur in relatione eorum udici ipsum morbum seu defectum specificare ne circumveniatur Ecclesia), et quod in eorum scientiâ, doctrinâ, experientiâ morbus aut defectus hujusmodi nullâ re aut arte medicâ curari possit, mulier obtinebit in causâ: hoc addito et allegato ex parte mulieris, quod ipsa sit juvenis et ad procreationem apta, et quod per *tres annos* insimul pernoctarunt, et quod, quamvis a marito cognosci cupiebat, ab eo tamen cognita non fuit nec cognosci potuit. Et si defectus non possunt directe per medicos et chirurgos juratos, judicari aut decerni; vel forsan dubia sit eorum relatio; allegetur ex parte mulieris, non solum quæ ultimo recitata sunt, sed etiam hoc addito:—*Quod sit virgo intacta nec a quoquam cognita.* Et ad hoc probandum judicialiter jurandæ sunt obstetrices ad inspiciendum mulierem, an vera sint hæc allegata. Et si judicio hujusmodi obstetricum, reperta fuerit virgo, saltem femina intacta nec a quouam cognita; et si vir non possit aliquos defectus objicere contra uxorem, ob uos cognosci non possit; hæc dictarum mulierum relatio cum judicio mediorum et chirurgorum (quamvis dubio) unà cum cæteris prædictis indiciis videlicet in eo quod mulier sit juvenis, et quod concubuit cum viro per triennium, ac quod ex aspectu apta et idonea videatur ad procreationem) sufficiunt ad divortium; seu potius ad pronunciandum *nullum ab initio* matrimonium fuisse inter hujusmodi personas: easque ab invicem, et ab omni vinculo et fœdere conjugali, liberas et immunes fuisse et esse. Et notu quod defectus objiciantur contra mulierem probandi sunt isto modo per inspeconem et relationem.'

A case came before the Vice-Chancellor's Court, in February 1845 (*Wilson Wilson*), in which the woman produced medical certificates to prove that she was 'virgo intacta!' In drawing up such a certificate, a medical reporter should bear in mind that females have become pregnant with what is commonly regarded as the chief sign of virginity *intact*. Indeed, the division of the hymen has been often rendered necessary for the delivery of a child. Negative evidence of non-consummation from the physical condition of a woman, is therefore of much less value, *cæteris paribus*, than the affirmative evidence from the existence of a physical defect in the man.

When the defect is not apparent on an examination, the case is attended with considerable difficulty. Divorce has, however, been granted even in these cases, when the husband has acknowledged his incapacity, and when, notwithstanding cohabitation for some years, this admission has been confirmed by an examination of the wife. Even when the male organs do not appear well developed, and sexual desire is absent, great caution is required in drawing up a report. In the case of *Bury*, the marriage was dissolved on the ground of impotency; but this man afterwards married, and had issue,—a fact which proved that 'ecclesia circumveniatur.' This gave rise to a difficult question: for it was contended, if the divorce was null, the second marriage was unlawful and the issue illegitimate. It was decided, however, that the second marriage was only voidable; and that, until dissolved, it remained a lawful marriage, and the children during coverture were legitimate. In investigating a case of this kind, when there is no apparent physical defect or malformation, it is necessary to examine the bodily state of the individual, whether he is effeminate, or on the other hand, has about him any or all of the usual marks which attend a virile state. In the latter case the impotency may be only temporary; and it would be decidedly unsafe to pronounce an opinion adverse to the existence of procreative power.

From these considerations, it will be perceived that, in order to justify a suit of divorce, on the ground of impotency or sterility, the impediment to intercourse or procreation should be established by good medical evidence, and it must be *apparent* and *irremediable*; it must also have existed before the marriage of the parties, and have been entirely unknown to the person suing for the divorce: if it has supervened after the marriage, this is no ground for a suit. The nature of the impediment is to be determined by private medical opinions or affidavits, based on an examination of *both* parties. There is one remarkable circumstance with respect to these cases; namely, that in nearly all of them, the suit is by the woman against the man; although there is no reason whatever to suppose that impotency and sexual malformation are more common in males, than malformation and sterility in females. We rarely hear of a husband instituting a suit of divorce on the ground of sterility (incapacity of procreation) in the wife; it is, I believe, in most instances, that the wife promotes the suit on the ground of impotency or incapacity of intercourse in the husband. The difficulty of establishing incapacity in the female, and the facility of proving impotency from physical causes in the male, may probably account for this difference. Suits of this kind are sometimes instituted many months and years after the union of the persons; but it is pretty certain that the desire for separation in these cases often depends on some other cause, which the law would not recognize as sufficient of itself, while it would admit the plea of impotency. The French law very judiciously applies the principle of condonation to such cases, so that no suit for nullity of marriage can be entertained, if cohabitation has continued for six months after the discovery of the personal defect. This appears to be more consistent with justice than our own law; but practically these suits, after protracted cohabitation, are always regarded with great suspicion. In one of these cases (*Castleden* v. *Castleden*) which came before the Divorce Court in Feb. 1860, the wife required a declaration of nullity of marriage on the ground of her husband's impotency. The parties were married in 1834 and cohabited until 1838. Of the three judges two were adverse to the petitioner's claim, and this was rejected. In *Marshall* v. *Marshall*, which came before the Court for divorce in July 1864, the wife petitioned for a decree of nullity of marriage on the ground of the impotency of the husband, the learned judge said he was not satisfied that the petitioner's case was established. He would, however, suspend his decree, and intimated his opinion that the petitioner ought for the present to return to cohabitation. If she refused, he would make an order to compel her to return; or, if she wished to appeal, he would formally dismiss the petition.

INFANTICIDE.

CHAPTER 68.

NATURE OF THE CRIME—EVIDENCE REQUIRED AS IN OTHER CASES OF MURDER—PROOF OF LIFE—BODY OF THE CHILD NOT DISCOVERED—MEDICAL EVIDENCE AT INQUESTS—UTERINE AGE OR MATURITY OF THE CHILD—VIABILITY—CHARACTERS OF THE CHILD FROM THE SIXTH TO THE NINTH MONTH—SIGNS OF MATURITY—RULES FOR INSPECTING THE BODY.

The subject of child-murder has of late years attracted the attention of medical jurists by reason of the facility with which the crime may be perpetrated, and the great difficulty of bringing it home to the offender. The reports of inquests show that the deaths of infants are very numerous, and that they frequently occur under circumstances involving great suspicion. In 1862 there were 20,591 inquests in England and Wales, and among these were 3,239 inquests on infants under one year, of whom 859 were illegitimate; out of 124 verdicts of wilful murder, more than half related to infants. In 1863 there were 22,757 inquests, and of these 3,664 were held upon children under one year; verdicts of murder were returned in 166 of these cases, and of these 79 were in Middlesex. In his annual report for 1862–3, Dr. Lankester, coroner for the central division of Middlesex, states that there were 68 deaths of new-born children in his district, and in 53 of these, verdicts of wilful murder were returned against persons unknown; it appears according to this report, that the crime is more frequent among women in domestic service than in any other class. The strongest motive for destroying the infant appears to be the shame and disgrace of having an illegitimate child; this is only attempted where pregnancy has not been discovered, and where the delivery has been effected in concealment; if the child has thus been secretly destroyed, the first opportunity is taken of casting its body into the streets; where the dead child is secreted on the premises, discovery generally takes place. In several instances the mothers of newly-born dead children have been brought before the Coroner's court, and although when the mother is not discovered, there is no reluctance on the part of a jury to return a verdict of wilful murder, there is considerable hesitation in doing so when the mother may be sent to take her trial for murder. In all instances in which the evidence of guilt has been so clear that coroner's juries have found verdicts of wilful murder, the prisoners have been subsequently acquitted on their trials. Such is the history of cases in which the crime has been detected, and as the present state of the law offers every facility to a woman thus detected, to escape punishment, the extensive existence of the crime of infanticide will not excite surprise. ('Annual Report,' 1864, p. 83.)

In France, child-murder appears to be common and on the increase. From statistical reports published in 1840 ('Ann. d'Hyg.,' vol. 2, p. 340) by Dr. Bayard, there were in 10 years 2,549 persons charged with child-murder; among these 1,210 only were put upon their trial, owing to the general failure of evidence against the mothers; out of this number 410 were convicted, and as extenuating circumstances were found in all cases, a correctional punishment only was inflicted. From a return lately made of the number of dead bodies exposed at the Morgue in Paris, it appears that in ten years, out of 3,344 bodies so exposed, there were 493 of new-born infants.

It will be seen from the nature of the medical proofs required, that a conviction for child-murder in England, in the present state of the law, seldom takes place. Notwithstanding the frequency of the crime, juries appear to shrink from returning a verdict of murder, even where the medical facts would fully justify it, but they almost invariably fall back upon the minor offence of which the accused person may be convicted, namely, that of concealment of birth. This, in fact, in reference to the crime with which the prisoner is charged, amounts to a verdict of not proven.

Nature of the crime.—By infanticide we are to understand in medical jurisprudence, the murder of a *new-born* child. The English law, however, does not regard child-murder as a specific crime; it is treated like any other case of murder, and is tried by those rules of evidence which are admitted in cases of felonious homicide. In stating that infanticide is the term applied to the murder of a *new-born* child, it is not thereby implied that the wilful killing should take place within any particular period after birth. Provided the child be actually born and its body entirely in the world, it matters not whether it has been destroyed within a few minutes or not until several days after its birth. In the greater number of cases of infanticide, however, we find that the murder is commonly perpetrated either at the time of birth, or within a few hours afterwards. Although the law of England treats a case of infanticide as one of ordinary murder, yet there is a difference in the nature of the medical evidence required to establish the murder of a new-born child. It is well known that many children come into the world dead, and that others die from various causes soon after birth; in the latter the signs of their having lived are frequently indistinct. Hence, to provide against the danger of erroneous accusations, the law humanely presumes that every new-born child has been born dead, until the contrary appears from medical or other evidence. The onus of proof that a living child has been destroyed, is thereby thrown on the prosecution, and no evidence imputing murder can be received, unless it be first made certain, by medical or other facts, that the child survived its birth, and was actually living when the alleged violence was offered to it. Hence there is a most difficult duty cast upon a medical witness on these occasions.

Body of the child not discovered.—In cases of child-murder, medical evidence is commonly founded on an examination of the body of the child; but it must be borne in mind, that a woman may be found guilty of the crime, although the body of the child is not discovered:—it may have been destroyed by burning, or otherwise disposed of, and a medical witness may have only a few calcined bones to examine. ('Ann. d'Hyg.' 1845, vol. 2, p. 129.) In these cases of the non-production of the body, good legal evidence of the murder would, however, be demanded; and this evidence should be such, as would fully establish a matter of fact before a jury. The production of the body of the child, is therefore no more necessary to conviction than in any other case of murder. A woman has been tried within the last few years for the murder of her child, the body of which was never discovered.

Medical evidence at inquests.—In most instances, however, the body of the child is found,—an inquest is held, and medical evidence is demanded. In giving evidence at a coroner's inquest on a case of child-murder, as much care should be taken by a practitioner, as if he were delivering it before a judge at the assizes. Some medical witnesses are disposed to treat an inquest with indifference, and to be careless in their evidence, thinking probably that should the case come to a trial, they could prepare themselves, and amend any statements which had been hastily made before a coroner's jury. But it should be remembered that the depositions taken by this officer are placed at the trial in the hands of the judge, as well as of the prisoner's counsel; and should a witness deviate in his evidence at the assizes from that which he gave at the inquest, or should he attempt to amend or explain any of the statements then made, so that they might, by the ingenuity of a barrister, be represented as having a new bearing on the prisoner's case, he would expose himself not merely to a severe cross-examination, but probably to the censure of the Court. If medical men were to reflect that in delivering their opinions before a coroner and jury, they are, in many instances, virtually delivering them before a superior Court, it is certain that many unfortunate exposures would be easily avoided.

UTERINE AGE OR MATURITY OF THE CHILD.

One of the first questions which a witness has to consider in a case of alleged child-murder is that which relates to the age or probable degree of maturity which the deceased child may have attained in utero. The reason for making this inquiry is, that the chances of natural death, in all new-born children, are great in proportion to their immaturity: and that, supposing them to have survived birth, the signs of their having breathed are commonly obscure. It is found that the greater number of children who are the subjects of these investigations have reached the eighth or ninth month of gestation: yet charges of murder might be extended to the wilful destruction of children at the seventh month or under, provided the evidence of life after birth was clear and satisfactory.

The English law does not act on the principle that a child, in order to become the subject of a charge of murder, should be born *viable*, *i.e.* with a capacity to live. It is observed by Mr. Chitty, although no authority is quoted for the statement, that 'the object of the law is to prevent injuries to infants having a capacity to maintain a separate existence;' and he further suggests that such a capacity should be proved, in order to complete the offence of infanticide. ('Med. Jour.' vol. 1, p. 411.) This argument, carried to its full extent, would render it no offence to put to death all persons afflicted with any mortal disease. I have been unable to find, in the numerous reported trials for infanticide, any ground for this statement. The capacity of a child continuing to live has never been put as a medical question in a case of alleged child-murder; and it is pretty certain that, if a want of capacity to live were actually proved, this would not render the party destroying it irresponsible for the offence. Children may be born alive at the sixth or seventh month; but because they are much less likely to survive than those born at the eighth or ninth month, this is not a ground for exculpation for any person who may wilfully destroy them. The real question, as we shall presently see, does not refer to the period of gestation at which a child may be born, but to the fact of its being *living* and *entirely born* when the murderous violence is offered to it. The French law, although it requires in some cases proof of viability in relation to the rights of inheritance, demands only proof of life after birth in reference to a charge of infanticide. (Briand, 'Man. Complet de Méd. Lég.' 201; also 'Ann. d'Hygiène,' 1863, vol. 1, p. 399.)

Although the doctrine of viability is not recognized in English jurisprudence, yet in a case which occurred in October 1836, a coroner refused to hold an inquest on the body of a child, because it had not reached an age (seven months) at which children are commonly born alive! In this case there was probably no harm done; but when we consider—1st, the great difficulty of determining the exact age of a child from the characters found on its body;

and 2ndly, that many children born under the seventh month have not only been born alive, but have lived to an adult age, the adoption of a principle of this kind would be likely to give rise to dangerous abuses. It is impossible to admit that children may be destroyed with impunity because they happen to be born under the seventh month, or that a child should be assumed to have been born dead and any enquiry into the cause of death dispensed with, unless it can be medically established that it has passed the seventh month of gestation.

According to one medico-legal authority, if it can be shown that the child which is the subject of investigation has not attained this age (the seventh month), no charge of infanticide *can* or *ought* to be entertained. Are we to understand by this that children proved to have been born living before the seventh month may be wilfully destroyed, and the law take no cognizance of the matter? If this be not the meaning, the statement amounts to nothing, because whether the child has reached the seventh, eighth, or ninth month, life and live birth must still be proved before a charge of murder can be made. I have known an instance of a child born between the sixth and seventh months living a fortnight; and many similar cases are recorded. On the doctrine above laid down, the deliberate destruction of such children, although actually living, ought not to be considered or treated as murder! It is satisfactory to know that such a principle as this is not recognized by the law of England. In the case of *Reg.* v. *West* (Nottingham Lent Assizes, 1848), a midwife was tried on a charge of causing the death of a child under the seventh month of uterine life (in the perpetration of abortion), not by direct violence applied to its body, but merely by leading to its premature birth. This case proves, therefore, that a charge of child-murder may be fairly entertained with respect to children *under* the seventh month. The woman in this instance was alleged to have been between the fifth and sixth months of pregnancy. The proof of this fact did not, however, prevent an indictment for murder and a full investigation of the case. We also learn from it, contrary to the suggestion of Mr. Chitty (*supra*), that the *viability* of a child is not by the English law required to be proved on an indictment for child-murder. This child was certainly from mere immaturity incapable of maintaining a separate existence, and it was therefore *not viable*; but the judge who tried the case, in answer to an objection taken by prisoner's counsel, said that if the child was proved to have died under the circumstances alleged for the prosecution, it would still be murder. As at an early uterine period the fœtus is not born living, no question of murder can arise, except it be so far developed as to be able to survive its birth. The earliest period at which a child can be born living has been elsewhere considered (see pp. 821, 849). In reference to children born at the fourth or fifth month of gestation, a charge of concealment of birth may arise so long as the offspring has human form. Under these circumstances it is not necessary to prove that it was born living. At the same time as such births at the fourth and fifth months are always the results of abortion either from natural or criminal causes, the charge is generally merged in the higher offence of procuring abortion. Here, again, it is not required to prove by medical evidence that the aborted fœtus was living when expelled from the uterus (p. 773, *ante*). In nearly all cases of child-murder it will be found that the child has passed the seventh month of gestation.

Characters from the sixth to the ninth month.—The following are the characters whereby we may judge of the uterine age of a child from the *sixth* to the *ninth* month of gestation, a period which may be considered to comprise cases of abortion as well as child-murder:—

1. Between the *sixth* and *seventh*: The child measures, from the vertex to

the sole of the foot, from ten to twelve inches, and weighs from one to three pounds. The head is large in proportion to the trunk; the eyelids are adherent, and the pupils are closed by membranes (membranæ pupillares). The skin is of a reddish colour, and the nails are slightly formed; the hair loses the silvery lustre which it previously possessed, and becomes darker. Ossification proceeds rapidly in the chest-bone, and in the bones of the foot; the brain continues smooth on its surface; there is no appearance of convolutions. In the male the testicles will be found in the abdominal cavity, lying upon the psoæ muscles immediately below the kidneys.

2. Between the *seventh* and *eighth* months: The child now measures between thirteen and fourteen inches in length, and weighs from three to four pounds. The skin is thick, of a more decidedly fibrous structure, and covered with a white unctuous matter which appears for the first time. Fat is deposited in the cellular tissue, whereby the body becomes round and plump; the skin previously to this is of a reddish colour, and commonly more or less shrivelled; the nails, which are somewhat firm, do not quite reach to the extremities of the fingers; the hair becomes long, thick, and coloured; ossification advances throughout the skeleton; valvulæ conniventes appear in the small intestines, and meconium is found occupying the cæcum and colon. The testicles in the male are considered about this period to commence their descent,—or rather, the child's head being downwards, their ascent towards the scrotum. The time at which these organs change their situation is probably subject to variation. According to J. Hunter, the testicles are situated in the abdomen at the seventh, and in the scrotum at the ninth month. Burns believes that at the eighth month they will commonly be found in the inguinal canals. The observation of the position of these organs in a new-born male child is of considerable importance in relation to maturity, and it may have an influence on questions of legitimacy as well as of child-murder. Mr. Curling thus describes their change of position:—At different periods between the fifth and sixth months of fœtal existence, or sometimes even later, the testicle begins to move from its situation near the kidney towards the abdominal ring, which it usually reaches about the *seventh* month. During the eighth month it generally traverses the inguinal canal, and by the end of the ninth, arrives at the bottom of the scrotum, in which situation it is commonly found at birth. ('Diseases of the Testis,' 2nd ed., p. 17.) Its absence from the scrotum does not necessarily indicate that the child is immature, because the organ sometimes does not reach the scrotum until after birth.

3. Between the *eighth* and *ninth* months: The child is from fifteen to sixteen inches in length, and weighs from four to five pounds. The eyelids are no longer adherent, and the membranæ pupillares have disappeared. The quantity of fat deposited beneath the skin is increased, and the hair and nails are well developed. The surface of the brain is grooved or fissured, but presents no regular convolutions: and the cineritious matter is not yet apparent. The meconium occupies almost entirely the large intestines; and the gall-bladder contains some traces of a liquid resembling bile. The testicles in the male may be found occupying some part of the inguinal canal, or they may be in the scrotum. The left testicle is sometimes in the scrotum, while the right is situated about the external ring.

4. *Ninth month. Signs of maturity.*—At the ninth month the average length of the body is about eighteen inches, and its weight from six to seven pounds: the male child is generally rather longer, and weighs rather more than the female. Extraordinary deviations in length and weight are occasionally met with. Mr. Owens has recorded a case in which a child at delivery measured twenty-four inches in length, and weighed seventeen pounds twelve ounces ('Lancet,' December 1838), and Dr. Meadows has reported another in which

a child measured after death thirty-two inches, and weighed eighteen pounds two ounces. It survived four hours. ('Med. Times and Gaz.' August 4, 1860.) In a case which I was required to examine in June 1842, the child, a male, measured twenty-two inches, and weighed twelve pounds and a half. (For some practical remarks on this subject, by Dr. Ellsässer, see Henke's 'Zeitschrift,' 1841, vol. 2, p. 235.) According to Dr. Duncan, the length and weight of the child vary according to the age of the mother. They are greatest among children when the mother is from 25 to 29 years of age. When a woman is 25, the child weighs less. The child of a woman at 22, weighed seven pounds three ounces, and that of a woman at 30, seven pounds seven ounces. The length varied in a less degree, being, for the different ages, at or about nineteen inches. ('Ed. Monthly Journal,' Dec. 1864, p. 500.)

At the full period the head of a child is large, and forms nearly one-fourth of the whole length of the body. The cellular tissue is filled with fat, so as to give considerable plumpness to the whole form, while the limbs are firm, hard, and rounded; the skin is pale; the hair is thick, long, and somewhat abundant; the nails are fully developed, and reach to the ends of the fingers—an appearance, however, which may be sometimes simulated in a premature child, by the shrinking of the skin after death. The testicles in the male are generally within the scrotum. Ossification will be found to have advanced considerably throughout the skeleton. (See, in relation to the progress of ossification, a paper by M. Ollivier, 'Ann. d'Hyg.' 1842, p. 243.) The surface of the brain presents convolutions, and the cineritious matter begins to show itself. The internal organs, principally those of the chest, undergo marked changes, if the act of respiration has been performed by the child before, during, or after its birth.

The relative position of the point at which the *umbilical cord* is attached to he abdomen, has been considered by some medical jurists to furnish evidence of the degree of maturity. Chaussier thought that in a mature child, at the ninth month, the point of attachment of the cord exactly corresponded to the centre of the length of his body. Later observations, however, have shown that this is not quite correct. Out of five hundred children examined by M. Moreau, at the Maternité, in Paris, the umbilical aperture corresponded to the centre of the body in *four* cases only. In the majority of these cases, the point of insertion was eight or nine lines below the centre. Among the cases of mature children which I have had an opportunity of examining, the umbilical aperture has generally been situated from a quarter to half an inch below the centre of the body. ('Guy's Hosp. Rep.' April 1842.) M. Moreau ound, on the other hand, that in some children, born about the sixth or ighth month, the cord was attached at the middle point of the length. ('Lanc. Franc.' 1837.) On the whole, it will be perceived that no value can be ttached to the situation of the umbilical opening, as a sign of maturity or mmaturity.

The characters which have been here described as belonging to a child at he different stages of gestation, must be regarded as representing an average tatement. They are, it is well known, open to numerous exceptions; for ome children at the ninth month are but little more developed than others at he seventh. (See p. 824.) Twins are generally smaller and less developed han single children; — the average weight of a twin child is not more than ve pounds, and very often below this. The safest rule to follow in endeavouring to determine the uterine age of a child is to rely upon a majority of the haracters which it presents. That child only can be regarded as *mature*, which presents the greater number of the characters above described, that re met with in children at or about the ninth month of gestation.

If the age of the child has been determined :—whether it be under or over the seventh month, the rules for a further investigation will be the same. Should the child be under the seventh month, the medical presumption will be, that it was born dead; but if it has arrived at its full period, then the presumption is that it was born alive.

Conclusions.—The following may be taken as a summary of the principal facts upon which our opinion respecting the uterine age of a child may be based:—

1. At *six months.*—Length, from nine to ten inches; weight, one to two pounds; eyelids agglutinated; pupils closed by membranæ pupillares; testicles not apparent in the male.

2. At *seven months.*—Length, from thirteen to fourteen inches; weight, three to four pounds; eyelids not adherent; membranæ pupillares disappearing; nails imperfectly developed; testicles not apparent in the male.

3. At *eight months.*—Length, from fourteen to sixteen inches; weight, from four to five pounds; membranæ pupillares absent; nails perfectly developed, and reaching to the ends of the fingers; testicles in the inguinal canal.

4. At *nine months.*—Length, from sixteen to twenty-one inches; weight, from five to nine pounds; membranæ pupillares absent; head well covered with fine hair; testicles in the scrotum; skin pale; the finger nails well formed and reaching to the ends of the fingers; features perfect—these and the body are *well developed* even when the length and weight of the child are less than those above assigned.

5. The point of attachment of the umbilical cord, with respect to the length of the body, affords no certain evidence of the degree of maturity.

Inspection of the body.—The questions which a medical jurist has to solve, in examining the body of a new-born child, are—1. To determine its age, or the stage of uterine life which it has reached;—2. Whether it has lived to breathe;—3. Whether it has been born alive;—4. The period of time which has elapsed since its death;—5. The cause of death, whether violent or natural.

Hence, before commencing the inspection—

1. The length (measured from the summit of the head to the sole of the foot) and weight of the body should be taken;—2. The presence or absence of external fœtal peculiarities noticed;—3. Any peculiar marks or indications of deformity whereby identity may be sometimes established;—4. All marks of violence, in the shape of wounds, bruises, or lacerations, and the kind of instrument or weapon by which they were probably produced; 5. Whether the umbilical cord has been cut and tied, or lacerated; the appearance of the divided vessels, and the length of that portion which is still attached to the body of the child; 6. The presence or absence of vernix caseosa about the groins, arm-pits, or neck—the presence of this substance proves that a child has not been washed or attended to;—7. It will be necessary to state whether there are about the body any marks of putrefaction, indicated by a separation of the cuticle, change of colour in the skin, or offensive odour. It is obvious, that unless these circumstances are noticed before the inspection is commenced, they may be entirely lost as evidence. Notes should be made on the spot, and the original retained, even if copies be subsequently made.

CHAPTER 69.

ON THE PROOFS OF A CHILD HAVING LIVED AT ITS BIRTH—EVIDENCE OF LIFE BEFORE RESPIRATION—SIGNS OF PUTREFACTION IN UTERO—EVIDENCE FROM MARKS OF VIOLENCE—EVIDENCE OF LIFE AFTER RESPIRATION—INSPECTION OF THE BODY—COLOUR, VOLUME, CONSISTENCY, AND ABSOLUTE WEIGHT OF THE LUNGS—STATIC TEST—WEIGHT INCREASED BY RESPIRATION—TEST OF PLOUCQUET—BLOOD IN THE PULMONARY VESSELS—SPECIFIC GRAVITY OF THE LUNGS.

On the proofs of a child having lived at its birth.—The question whether a child was or was not *born alive*, is of the greatest importance in a case of alleged child-murder; and it is unfortunately one which, in respect to the proofs upon which medical evidence is commonly founded, has given rise to considerable controversy. When it is stated that in most cases of alleged infanticide which end in acquittals in spite of the strongest moral presumptions of guilt, the proof fails on this point only, it must be obvious that this question specially claims the attention of a medical jurist. The medical evidence of a child having been alive, when violence was offered to it at its birth or afterwards, may be divided into two parts: 1, that which is obtainable before the act of respiration is performed; and 2, that which is obtainable afterwards. At present it will be proper to confine our attention to the question, whether the child was *alive* when it was maltreated,—the fact of its having been *born* alive will be a matter for future consideration. These two questions have been frequently but improperly associated, thus rendering the subject confused; but it must be so obvious as scarcely to require stating, that violence of a murderous kind may be offered to a living child *before* it is entirely born; and that owing to this violence it may come into the world dead.

EVIDENCE OF LIFE BEFORE RESPIRATION.

It was formerly supposed, if the lungs contained no air, that the child could not have respired, and it must have been born dead. But neither of these views is correct:—children have been known to breathe feebly, and continue in existence many hours without visibly distending the cells of the lungs with air,—the absence of air from the lungs, therefore, furnishes no proof either that respiration has not been performed, or that the child has not lived. ('G. H. Rep.' April 1842.) The restoration of many children apparently born dead is a clear proof that many are born living who might be pronounced dead, simply because breathing and life have been considered synonymous terms. (See on this subject a paper by Dr. Märklin, 'Casper's Vierteljahrschr.' 1859, vol. 2, p. 26; also an article in the same volume 'Leben ohne athmen,' p. 297.) That our law-authorities will admit evidence of life in a child before the establishment of respiration, is clear from the decision in *Rex* v. *Brain*, in which the judge said, that a child might be born alive, and not breathe for some time after its birth ('Archbold, Crim. Plead.' 367), as also from the charge of Coltman J. in the case of *Rex* v. *Sellis* (Norf. Spr. Circ. 1837). In this instance it was alleged that the prisoner had murdered her child by cutting off its head. The judge directed the jury, that if the child was *alive* at the time of the act, it was not necessary, in order to constitute murder, that it should have breathed. In fact, it would appear that respiration is regarded as only *one* proof of life; and the law will, therefore, receive any other kind of evidence which may satisfactorily show that the child has lived, and make up for the proof commonly derived from the state of the lungs. It will be first necessary for a medical practitioner to prove that the child under examination has recently died, or in other words, that there are good grounds for believing it to have been *recently living*. Hence, if the body be highly putrefied, either from the child having died in the uterus some time before birth, or from its having been born and its body not discovered until putrefaction had far advanced both internally and externally, the case is utterly hopeless. The medical witness will in general be compelled to abandon the investigation, because the body can furnish no evidence whatever of life after birth. The examination of the thoracic organs would throw no light on the case, for here we are assuming that the lungs are in their fœtal condition.

Signs of putrefaction in utero.—The phenomena of putrefaction in air have been elsewhere described (p. 49, *ante*); but the changes which ensue when a child dies and is retained within the uterus, may be briefly adverted to, because they may sometimes form a subject for judicial inquiry. According to Devergie, when a child dies in utero, putrefaction takes place as rapidly as in the open air ('Méd. Lég.' 1, 526); but this is doubtful. In an advanced state of *uterine putrefaction*, the body of the child is so flaccid, that when placed on a table it becomes almost flattened by the mere gravitation of its parts. The skin is of a reddish-brown colour, not green as in a putrefied body exposed to air. The cuticle covering the feet and hands is white, and sometimes raised in blisters,—the cellular membrane is filled with a reddish-coloured serum, the bones are moveable, and readily detached from the soft parts. In the opinion of Devergie, the principal difference between uterine and atmospheric putrefaction in the body of a new-born child, is seen in the colour assumed by the skin:—but it must be remembered, that should the child remain exposed to the air after its expulsion, the skin may acquire the colour observed in cases of atmospheric putrefaction. The changes which have just been described are such as we may expect to find when a child has been retained in the uterus eight or ten days after its death. When it has remained for some weeks in the uterine cavity, the body has occasionally been found in an adipocerous state (p. 63), or even encrusted with phosphate of lime. If in any case we are able to state distinctly that the body of a child has undergone uterine and not atmospheric putrefaction, it is clear that it could not have come into the world alive. Under ordinary putrefaction in air, a child may have been really brought into the world living, and the process may have destroyed every proof of that fact.

Let us suppose that the child died in utero from forty-eight to twenty-four hours before it was born: if it be soon afterwards examined, there will be no marks of putrefaction about it, and the appearances will closely resemble those met with in the body of a child that has been born alive, and died without breathing: or of one that may not have been born alive, but have died in the act of birth. It will be impossible to say, in such a case, whether the child came into the world living or dead.

Evidence from marks of violence.—It has been proposed to seek for evidence of life, under these circumstances, by observing the characters presented by marks of violence on the body. In general, when children are murdered, the amount of violence inflicted is considerably greater than that which is required to destroy them, whereby satisfactory proofs of the crime are occasionally obtained. On the other hand, the body of a still-born child, dead from natural causes, is often covered with lividities and ecchymoses;—the fœtal blood does not coagulate with the same firmness as in the adult: hence the evidence derivable from the extent, situation, and characters of marks of violence, is generally of too vague and uncertain a kind to allow of the expression of a medical opinion that the child was living when the violence was offered to it. The characters which have been already described as peculiar to wounds and contusions inflicted during life, may be met with in a child, whether it has breathed, or died without breathing. So, again, these characters are open to the exceptions there pointed out; for they will be equally present, supposing the wounds to have been inflicted immediately after the cessation of respiration or circulation in the child, or after the cessation of circulation only, —if the act of respiration has not been performed. Marks of violence on the body of a child that had died in utero twenty-four or forty-eight hours before it was born, would not present the characters of injuries inflicted on the living. There would be no ecchymosis and no effused coagula of blood. These marks, when they exist, although they may establish that a child was either living or but recently dead at the time they were inflicted, can never show that it was born alive. Injuries met with on the bodies of children alleged to have been born dead ought, however, to be of such a nature as to be readily explicable on the supposition of their having arisen from accident. If, from their nature, extent, or situation, they are such as to evince a wilful design to injure, it is a fair ground for a jury,—not for a medical witness, to inquire why these extensive wounds, or other marks of violence, were inflicted on a child, if, as it is alleged, it was really born dead. It must be confessed that in such a case there would be a strong moral presumption of murder, although medical proof of life, or actually live birth, might totally fail.

As a summary of these remarks, it may be observed, that although physiologically a child may live for a certain period after its birth without breathing,—and legally its destruction during this period would amount to murder, yet there are at present no satisfactory medical data to enable a witness to express a positive opinion on this point. If other evidence were adduced of a child having lived and been destroyed under these circumstances,—as where, for example, a woman causes herself to be delivered in a water-bath, or an accomplice covers the mouth of an infant in the act of birth, or immediately after it is born,—a medical witness would be justified in asserting that the absence of the signs of respiration in the lungs was no proof that the child had been born dead. Indeed, it is apparent that the process could not be established, owing to the criminal means actually employed to prevent it. Whether a jury would convict upon such evidence is doubtful; but this is of no importance to the witness:—his statements ought always to be made according to correct and well-ascertained medical principles, and not for the purpose of procuring either the conviction or acquittal of persons accused of offences against the law. In general, those cases in which questions relative to life before respiration might arise are stopped in the Coroner's court,—the usual practice being, when the signs of respiration are absent or imperfect, to pronounce that the child was born *dead*. If the lungs sank in water, the presence of marks of violence on the body would be considered as furnishing no evidence:—for the sinking of the lungs would be taken as positive evidence of still-birth, an inference upon which some remarks will be made in speaking of the hydrostatic test. The following case was the subject of a criminal charge at Havre:—A woman was delivered of twins. So soon as the first child was born, but not before it had breathed, she killed it by fracturing its skull with a wooden shoe. In a few minutes afterwards the second child was born, but scarcely had its head presented, when she seized it and fractured its skull in a similar manner. This double crime was soon discovered. On an examination of the bodies of both children, the same degree of violence was found, presenting in each case precisely similar characters. There could be no doubt, from the appearance of the injuries, that they must have been inflicted on both children at a time when the circulation was going on. In one child, however, it was proved that respiration had taken place; in the other that it had not. In the latter case many practitioners would at once have affirmed that the child had not lived, because there was no proof that it had respired; and they would have proceeded to draw the inference that this could not have been a case of infanticide. Dr. Bellot, however, stated that, although the child had not breathed, he had no doubt, it had been *born alive*, and that it would have lived to breathe, but for the violence inflicted. This opinion was chiefly founded upon the similarity in the characters presented by the marks of violence in the two cases. ('Annales d'Hygiène,' 1832, vol. 2, p. 199.) See further remarks upon this subject, by M. Ollivier, 'Ann. d'Hyg.' 1843, vol. 1, p. 149; also by M. Devergie, 'Méd. Lég.' 1837, vol. 1, p. 400.

The great question involved in this, and in all similar cases, is the following:—Does the law regard the wilful *prevention of respiration* as murder? There cannot be the slightest medical doubt that living children are occasionally thus destroyed in the act of birth: they die, not from the actual infliction of violence, but because, either through accident or design, the performance of that act which is necessary to maintain existence when the child is born, is prevented. Such a case has not yet been decided, although from the dicta of our judges, it would probably involve a charge of murder. In a case published by Dr. Wharrie, a pregnant woman, thinking she was about to have a motion, sat on an earthen pitcher, two feet in depth, which happened to be full of water. She was there delivered of a child, which fell into the water, and was thus prevented from breathing. The child was full-grown, and its body was free from putrescency. It weighed six pounds, and measured twenty inches. There were no external marks of violence, and the cord had been *tied*. The lungs weighed two and a half ounces; they were of a liver colour, contained no air, and sank in water. The medical opinion was, that from the size and general appearance of the child, and the state of the parts discovered on dissection, it was mature,—that it had never breathed, and life might have been either wilfully or accidentally destroyed. The examiners wisely declined giving the usual opinion from the sinking of the lungs; *i. e.* that the child had been born dead. The woman was not prosecuted, probably on the assumption that the death of the child might have been accidental. As Dr. Wharrie truly observes, there was no medical proof that the child was born alive; although there was a strong moral presumption that its life was destroyed in the act of birth. ('Ed. Monthly Jour.' Oct. 1845, p. 796.)

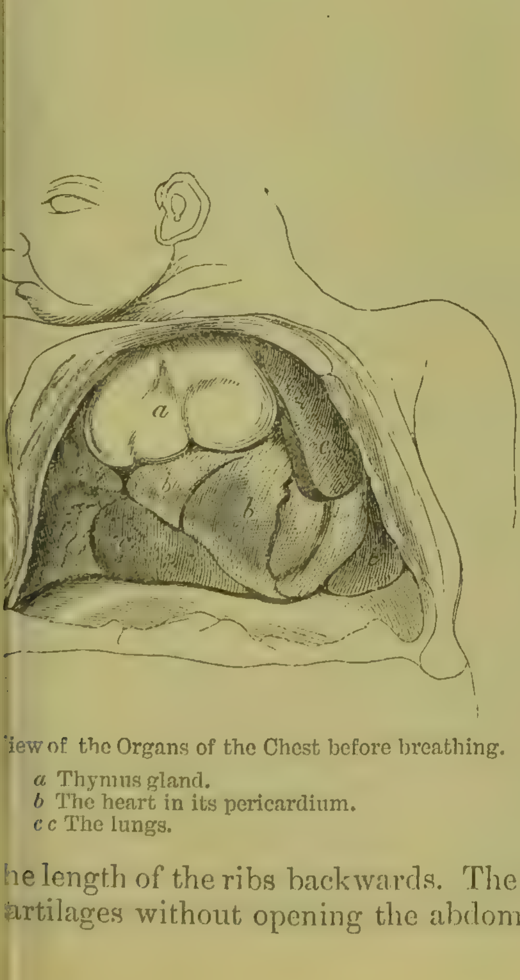
Dr. Bayard mentions a case, in which a woman, under somewhat similar circumstances, was convicted of the murder of her infant. In this case there was no evidence of respiration, but the woman admitted that she fractured the skull of the child, with the intention of destroying it, thinking that she perceived a motion in its legs after it was born. ('Ann. d'Hyg.' 1847, vol. 1, p. 455.) One physician thought that the child was living when the blows were inflicted; two others that it was dead. In Dr. Bayard's opinion the absence of the signs of respiration must be taken as a circumstance in favour of the accused.

EVIDENCE OF LIFE AFTER RESPIRATION.

There is no doubt that the proof of the act of respiration furnishes the best and strongest evidence of a child having lived at or about the time it was born. In does not, however, show that a child has been *born alive*. The physical changes in the organs of a child, which result from the establishment of this process take place in the lungs immediately, but in the heart and its appendages more slowly. It is therefore chiefly to the *lungs* that a medical witness looks for proofs of respiration. Sometimes, however, these organs are found in their fœtal condition, or nearly so:—for although a child may have survived its birth many hours, there may be no evidence of the fact from the state of the lungs. To such cases the remarks now about to be made cannot of course apply:—the proofs of life must then be sought for elsewhere, and if none can be found, the case is beyond the reach of medical evidence. But it is obvious that the occasional occurrence of cases of this description can present no objection to our still seeking for proofs of life in the state of the lungs, any more than the fact of poison not being always discovered in the body of one who has died from poisoning would be a bar to our seeking for the proofs of poison in every unknown case which presented itself. It is the more necessary to insist upon this point, because some have held, that, as we cannot always derive proofs of life from an examination of the lungs of new-born children, we should abandon all evidence of this description, and leave the case in its original obscurity. The very object of medical jurisprudence is, to endeavour to remove these difficulties, and to show in every department of the science, the degree to which we may safely trust the medical proofs of crime, however insufficient, inconsistent, or contradictory they may at first sight appear.

Examination of the lungs.—Some have pretended that the fact of respiration having been performed, would be indicated by the *external form of the chest.* Thus it is said, before respiration the chest is flattened, while after that process it is arched in front. The diameters of the cavity have also been measured, and certain comparisons instituted (Daniel), but these experiments have been attended with no practical results, and have long been abandoned by medical jurists. Admitting that such a visible change of form is occasionally produced by respiration, it is obvious that in these cases, experiments on the lungs may be readily made; and on the results of these, and not upon minute changes in the capacity of the chest, would a medical opinion be based. The cavity of the chest may be conveniently laid open by carrying ncisions from below the clavicles downwards on each side from about half

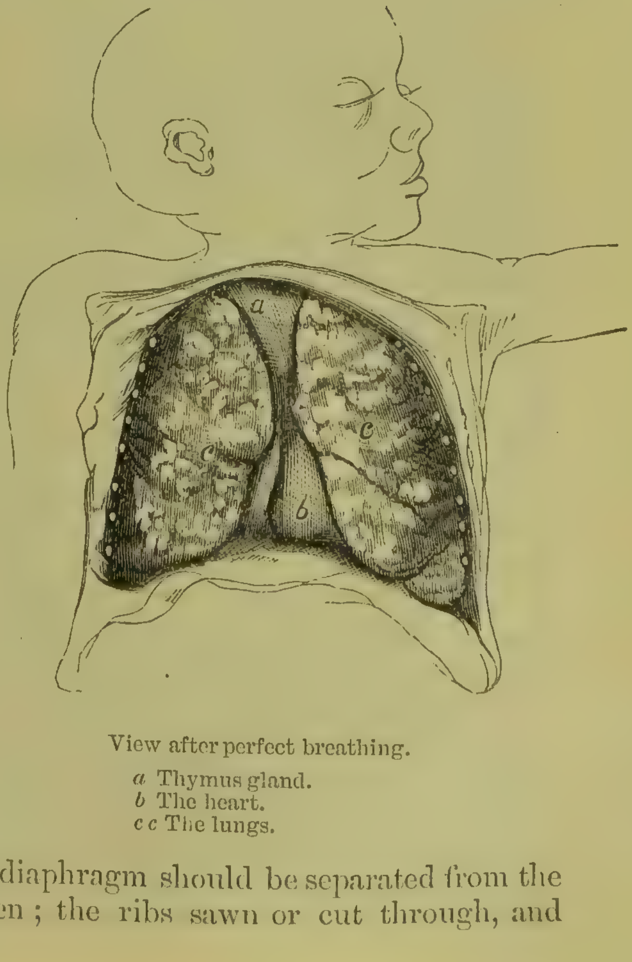
FIG. 1.



iew of the Organs of the Chest before breathing.

a Thymus gland.
b The heart in its pericardium.
c c The lungs.

FIG. 2.



View after perfect breathing.

a Thymus gland.
b The heart.
c c The lungs.

he length of the ribs backwards. The diaphragm should be separated from the artilages without opening the abdomen; the ribs sawn or cut through, and the flap formed by the anterior parietes of the chest turned upwards. The illustrations at p. 895 will serve to show the difference in the relative position of the organs of the chest before and after respiration. 1. If a child has *not breathed*, the appearances will be seen as in fig. 1. The thymus gland, as large as the heart, occupies the upper and middle portions of the cavity;—the heart within its membrane (pericardium) is situated in the lower and middle portion, and is rather inclined to the left side. The lungs are placed quite in the back part of the chest, so as often to give the impression that they are wanting. In some instances they project slightly forwards by their anterior margins, but in no instance, unless congested, infiltrated, or otherwise diseased, do they cover and conceal the heart. The thymus gland is sometimes of a pale fawn —at others of a deep livid colour; but there is no perceptible difference in this organ in new-born children, before or after the performance of respiration. 2. On the other hand, when a child has *fully breathed*, the most striking differences will be observed in the colour and prominence of the lungs. They are of a light red hue, project forwards—appear to fill the entire cavity of the chest, and cover, and in great part conceal by their anterior margins, the heart and its membrane. (Fig. 2.) We may meet with every variety in the appearances between these two extremes: for the process of respiration often requires a considerable time in order that it should be *fully* established, especially in those children which are of a weakly constitution or prematurely born. Hence the lungs will be found to occupy their respective cavities to a greater or less extent, and to cover the pericardium more or less, not according to the length of time which a child has lived, but according to the perfection with which the process of respiration has been performed. It will be seen hereafter, that although, as a general rule, the lungs are more perfectly filled with air in proportion to the time during which a child survives its birth, yet this is open to numerous exceptions. It will next be necessary to give particular attention to certain other physical characters presented by the lungs.

1. *Colour of the lungs.*—The colour of the lungs *before respiration* is bluish red, or deep violet, but it is subject to variation. Some medical jurists have compared it to the colour of the spleen. It is important to remark, that a very short exposure to air will materially brighten the colour of the lungs in the parts exposed, so that it should be observed and recorded immediately on opening the chest. *After respiration*, the lungs acquire a light red hue in proportion to the degree in which the process has been performed. If imperfectly established, they will be mottled, generally about the anterior surfaces and margins, the patches of light red being intermixed with the livid fœtal hue, and being slightly raised, as if by distension, above the general surface of the organs. The light red tint changes, after a short exposure to air, to a bright scarlet. This change in the colour of the lungs is not a necessary, nor is it an invariable consequence of a child having lived after its birth. I have known a child to live twenty-four hours respiring feebly, and on examining the body, the colour of the lungs was identical with that of the organs in the fœtal state. The change of colour is then a usual, but by no means a necessary consequence of the enjoyment of life:—so that the retention of the fœtal colour does not furnish positive evidence of still birth. Again, the circumstance of the lungs having a light red colour is not an infallible criterion of the child having lived and breathed; for the artificial introduction of air by a tracheal tube, or otherwise, in the attempt to resuscitate a still-born child, is attended with the same physical change. In the course of numerous experiments, purposely made, I have found no appreciable difference. Bernt says, that artificial inflation will not produce a scarlet red colour in the organs, and therefore that this is a criterion of respiration. ('Ed. Med. and Surg. Jour.' vol. 26, p. 367.) I have not only observed this colour to be

absent after respiration, but have actually produced it by artificial inflation in the lungs of a dead child.

2. *Volume of the lungs.*—The difference in the relative situation of the lungs before and after respiration, has been already described. This difference depends entirely upon the increased volume or dilatation of the organs, arising from the introduction of air. *Before respiration*, the lungs are in general scarcely visible, unless forcibly drawn forwards in the chest. When it has been perfectly accomplished, the volume is so much increased, that the bag of the heart (pericardium) is almost concealed by them. Respiration must, however, have been very perfectly performed in order that this condition should exist to the full extent described; but I have known the lungs to acquire a considerable volume in a healthy and vigorous child from only two or three respirations. The child was destroyed by craniotomy, and died before it was entirely born. In other instances a child may live for one or two days, and the volume of the organs be but little altered. Schmitt has remarked, that the lungs have sometimes a considerable volume before respiration. I have met with this in more than one instance; but this condition will be found in general to depend on disease. As the altered volume of the healthy lungs depends on the introduction of air, the effect is the same whether the air be derived from the act of breathing, from artificial inflation, or from putrefaction. Other circumstances must therefore be considered, before we draw any inference from this physical change.

3. *Consistency of the lungs.*—The lungs, *before respiration*, feel like the liver, or any other of the soft organs of the body. They are firm under the finger, but their substance may be lacerated by violent compression. *After respiration* has been fully performed, there is a distinct sensation of what is termed crepitation, on compressing them, *i.e.* air is felt within them. This condition of the organs must, of course, depend on the degree to which respiration has been carried. The lungs of children that have lived for a considerable time after birth will sometimes give no feeling of crepitation under the finger. Generally speaking, lungs of this kind present the other fœtal characters: thus they are small and of a livid colour. There are, however, cases in which the lungs may have the light red colour of respiration, and be actually much dilated in appearance, yet no feeling of crepitation will be perceptible on pressure. This character therefore is by no means a necessary accompaniment of the other two. Crepitation furnishes a presumptive evidence of respiration; but it may be equally met with in lungs that are putrefied, or which have received air by artificial inflation. The characters here described are seldom found in the lungs of children that have been born prematurely, although these children may have lived some time after birth: they depend on respiration, and in the exceptional cases referred to, this process is only slowly established. Independently of the feeling conveyed by the presence of air, a section of the lungs examined by the microscope will enable the examiner to form an opinion whether air has or has not penetrated into them; in the former condition air-cells will be visible, and when the cut surface is pressed, blood and froth will escape.

4. *Absolute weight of the lungs. The static test.*—The absolute weight of the lungs before respiration is less than that which they have after the establishment of the process. From this an inference has been drawn that the absolute weight of the lungs in an unknown case, compared with certain averages, will aid the enquirer in ascertaining whether respiration has or has not been performed. In order to determine the weight of the lungs, these organs should be carefully separated by dissection from the heart and thymus-gland, and removed with the trachea and bronchi attached. Previously to their removal, ligatures should be placed on the pulmonary vessels, so that no blood may escape from the lungs. They should now be weighed, and the weight accu-

rately noted in grains. In taking this weight it does not appear necessary to make any distinction founded on the sex of the child, or on the difference of weight in the two lungs; the only exception would be, perhaps, in relation to twin children imperfectly developed. The average weight *before respiration*, derived from nine cases, was found to be 649 grains. According to Dr. Traill, the weight varies from 430 to 600 grains. It is of importance in taking the weight of these organs to observe whether the child is at or near maturity, and whether it is of or about *the average size and weight*: owing to a neglect of this rule, it is highly probable that comparisons have been made of the absolute weight of the lungs in children of different ages, which a full statement of the facts would not have justified. If it be small and immature, or unusually large, the lungs will weigh either less or more than the average. The average weight of the lungs, *after respiration*, derived from three cases, was 927 grains; but in making an estimate of this kind, much will depend upon the degree to which respiration has been carried. In three cases, in which the children lived half an hour, six hours, and twenty-four hours, respectively, the process had been so imperfectly performed, that the lungs varied but little in weight from the average before respiration. (‘G. H. Rep.’ No. V.) The truth is, we cannot compare the lungs of children, as to weight, according to the *time* which they may have survived birth, but rather according to the *degree* to which the lungs have been penetrated by air. In one instance of alleged child-murder, where a child was probably killed soon after birth, the lungs weighed 1,000 grains. In another instance, where the child had certainly lived eight or nine days, the lungs weighed only 861 grains. In the first case, respiration had been perfectly performed; in the second, imperfectly. Hence, to say that the lungs weighed so much *after* respiration, amounts to nothing, unless we can estimate, by a sight of the organs, its degree; and any calculation founded upon such dissimilar cases must unavoidably lead to error. This increase of weight after birth is commonly ascribed to the altered course of the blood, under the establishment of the respiratory process, as well as to the fact, that more blood circulates through the lungs after than before respiration. Practically, this view is confirmed by the contraction of the ductus arteriosus, and the simultaneous enlargement of the pulmonary arteries; changes which have been occasionally observed when the child has survived its birth for only a very short period. As these normal changes in the duct depend on the establishment of respiration, so we cannot expect to find them when the process has been imperfectly performed, although the child may have lived several days. Another circumstance must also be considered in basing an opinion on the absolute weight of the lungs; although there does not appear to be any strict normal relation between the weights of the body and lungs in new-born children, it is certain that in the bodies of children of unusual weight, the lungs will be found much heavier than the average, whether the child has breathed or not. The body may vary, from six to eighteen pounds; the lungs under these circumstances will also differ in weight.

Weight of the lungs increased by respiration.—The healthy lungs of mature new-born children, become heavier after respiration, and according to its degree; and where a deviation from this rule is observed, it may probably be explained by the circumstance that the lungs of an immature have been compared with those of a mature child—the lungs of an undeveloped twin with those of one not a twin, or the lungs of one which has breathed imperfectly with those of another in which respiration has become well established. In this respect the extensive tables drawn up by Lecieux, are liable to lead to erroneous inferences, relative to the effect of respiration on the absolute weight of the lungs. The weights of the organs are noted, but the *degree* to which respiration had been performed is so loosely stated as to allow of no fair inference of the effect of this process upon the weight. The time which the children survived is stated; but this, it is very well known, furnishes no criterion of the degree to which respiration has been carried. Again, we are not informed whether due care was taken to ascertain if the lungs were healthy or diseased. ('Considérations sur l'Infanticide.' Paris, 1819.) The following table of the weight of the lungs, in four cases, will show how much the organs are liable to vary in weight after birth, according to the *degree* of respiration :—

Case 1.	Born dead	Weight,	687 grs.
2.	Lived 6 hours	,,	774
3.	Lived 24 hours	,,	675
4.	Lived 9 hours	,,	861

Relying upon a table of this kind only, without comparing the other characters of the lungs with the weight, it might be inferred that the organs would weigh less in a child which had survived its birth twenty-four hours, than in another which had been born dead, and that there would be very little difference in the weight, whether the child lived six hours or nine days; but when it is stated that in Case 3 the lungs had every fœtal character possessed by those in Case 1, and that in Case 4 respiration had been obviously very imperfectly performed, the difficulty is removed. Such cases should rather be compared with the lungs in the fœtal than in the respired state. They merely show what is very well known to, and admitted by all medical jurists, that there are some instances in which the fact of respiration cannot be determined by the application of the static, or any other test to the lungs. But this is certainly no valid reason why evidence from this source is to be rejected in all other cases. It may be fairly granted that the weight of the lungs of some children that have outlived delivery may not come up to the weight assigned to those of children that have breathed; because, as we have seen, children may survive birth many hours without the process of respiration being properly established. On the other hand, as in Chaussier's observations, the lungs of the still-born may be sometimes as heavy as those of children that have respired; but since the lungs of the still-born would contain no traces of air, the weight above the average in these cases could not be assigned to respiration. Among such subjects, whatever might be the weight of the lungs, if the facts were unknown it would be impossible to say whether the children were born living or dead. (See 'Ed. M. and S. J.' vol. 26, p. 375.) Increased weight, therefore, is only one among several circumstances to which a medical jurist should attend.

We must not fall into the error of supposing that the lungs increase in weight according to the length of time which a child survives its birth; it is within the limits of a few days, according to the degree of perfection with which a child breathes; hence we may meet with cases of children born alive, surviving some hours or days, and yet after death the lungs will retain their fœtal weight. This is observed in immature children, in most twin children, and in those which are mature but weakly. Among many instances that have come to my knowledge, no difficulty of this sort, however, has occurred. The signs of respiration have been sufficiently well developed to justify a medical opinion, although the child had probably not survived its birth above a few hours, or even minutes. ('G. H. Rep.' April 1842.) The cases of imperfect respiration above alluded to, rarely go beyond a coroner's inquest, for want of clear evidence of life. There may be a difference of opinion as to the relative number of instances of perfect and imperfect respiration in new-born children; but a case is never likely to proceed to trial, unless signs of this process are well marked; and thus some who are charged with murder on strong suspicion escape through the want of sufficient medical evidence to establish the fact of respiration and life.

It is scarcely necessary to observe that the air which the lungs receive by respiration cannot add to their absolute weight. This is because they are in the condition of a bladder, which weighs the same whether it be filled with air or empty. The increase of weight is solely due to the additional quantity of blood, which, owing to the altered course of the circulation, permeates their structure. Hence it follows that, when the lungs are distended with air, either from artificial inflation or from putrefaction, the fœtal weight will remain unaltered; and by this means, it is contended, we may distinguish lungs that have breathed from those which have been artificially inflated. Orfila states that the fœtal lungs weigh more before they are artificially inflated than afterwards—a circumstance which may depend upon the fact that the impulse employed in inflation may have forced out a portion of blood or other liquid. In carefully performing this experiment, I have found that there was not even the least fractional difference, but that the inflated lungs weighed precisely the same as in the uninflated state. From what has already been said, it follows that great weight of the lungs can obviously furnish no proof of respiration, unless this be accompanied by the other physical changes indicative of that process; as, for example, great increase in volume from the presence of air and crepitation. If the lungs be very heavy, and at the same time contain little or no air, it is certain that the increase of weight must depend upon disease or other causes—not upon respiration. In one case which I had to examine the lungs were large, and weighed upwards of 1200 grains. They contained no air; when divided into thirty pieces, not one portion floated, nor could any air be seen on the closest examination. It was therefore clearly impossible to ascribe a weight so much above the average to the effects of respiration. On the other hand, in a case communicated to me by Mr. Cann of Dawlish, the lungs of a new-born child apparently full-grown, although fully distended with air, weighed only 626 grains. In this case the body of the child weighed only six pounds, and a quantity of blood had no doubt escaped from the lungs, owing to the pulmonary vessels not having been tied before their removal from the chest. It must not be forgotten that all the physical characters presented by lungs that have respired are liable to certain fallacies; but, as in the evidence derived from tests used in poisoning, these may be removed, or the force of the objection diminished, by not basing an opinion on one or two conditions only. We should take the whole combined; for it would be as wrong to regard great weight in the lungs *taken alone* as an absolute proof of respiration as it would be to draw the same inference from a mere change in the colour, volume, or consistency of the organs. This is in accordance with the view adopted by the late Professor Orfila. ('Méd. Lég.' 1848, vol. 2, p. 229.)

5. *Test of Ploucquet.*—This so-called test for determining whether or not the act of respiration has taken place was proposed many years since by M. Ploucquet. It is founded on a comparison of the absolute weight of the lungs with the weight of the body of a child. Admitting that the lungs increased in weight from the establishment of the respiratory process, it was supposed that a like difference would take place in the relative weight of these organs to the body; and that the ratios thus procured, compared with certain averages, would enable a medical jurist to determine, in an unknown case, whether or not a child had breathed.

Ploucquet conceived that the average ratio of the weight of the lungs to the body, in children which had not breathed, was 1 : 70; and in those which had breathed, 2 : 70 or 1 : 35. Subsequent researches, however, made by Chaussier and others have shown that these numbers cannot be considered to represent the true average. The most serious objection to the employment of this test, in cases of infanticide, is, that the lungs and the body are liable to vary in their relative weights in children of the same age; and, *à fortiori*, this variation must exist to a greater extent among children which have reached different ages. There may be various degrees of development in the body of a child without any necessity existing for a corresponding development taking place in the lungs. It is unnecessary to enter into speculations relative to the causes: experience has shown that such variations really exist; and all that a medical jurist has to consider is, whether the difference can be reduced within limits which may make the test available in practice. M. Devergie states from his experiments that Ploucquet's test affords no satisfactory results when applied to the bodies of children that have not reached the eighth month of gestation. According to him, the ratio is, for the Eighth month—Before respiration, 1 : 63; after respiration, 1 : 37; Ninth month—Before respiration, 1 : 60; after respiration, 1 : 45. The ratio, he observes, becomes higher after respiration in proportion to the perfection with which the process has been carried on. ('Médecine Légale,' vol. 1, p. 556. See also 'Ann. d'Hyg.' 1835, vol. 1, p. 485; 'Med. Gaz.' November 1842, p. 208.) The facts which have been collected by different observers appear to me to show that Ploucquet's test is not fitted to determine, in an unknown case, whether a child has breathed or not.

6. *Blood in the pulmonary vessels.*—It has been asserted that if blood be found in the pulmonary vessels of a new-born child, we are justified in assuming that respiration has taken place. On the other hand, the absence of blood from these vessels has been considered to prove that a child has not breathed. This assertion must have originated in a want of correct observation. The pulmonary vessels contain blood, both in the child which has and n that which has not breathed. It is possible that the vessels may contain more after respiration than before; but in most cases of infanticide it would be difficult to found any distinction on a point of this nature. In examining the bodies of children that have died without breathing, and those of others that have lived and breathed for some time after birth, no perceptible difference was found in the quantity of blood existing in the vessels in the two cases. The fact is, the excess of blood after the establishment of respiration s distributed throughout the minute capillary system of the lungs: it does ot remain in the large trunks. The state of the pulmonary vessels, therefore, urnishes no evidence either of respiration or the contrary. The same observation will apply to the presence of blood in the substance of the lungs. t is said that on cutting through lungs that have breathed the incisions are ollowed by a copious flow of blood; this, it is alleged, does not happen with ungs that have not breathed. In performing this experiment on the lungs of ew-born children, I have not been able to perceive any well-marked ifference in quantity. The blood may be found coagulated or not, and there s no difference in this condition, whether the child is born living or dead.

7. *Relative proportion of fat in the lungs.*—In July 1847, a memoir was resented to the Academy of Sciences by M. Guillot, in which the author roposed to determine the question of respiration by the relative proportion f fat contained in the lungs before and after birth. According to M. Guillot, he quantity of fat contained in the pulmonary tissue is always greater before han after respiration, and it begins to diminish from the moment that the act f breathing commences. Before respiration, the dried lungs yield from 10 18 per cent. of fat: after respiration, not more than 6 per cent. The process followed by M Guillot is to dry the organs at a high temperature, so as expel all the water, reduce them to powder, and digest this powder in ether. Comptes Rendus,' Juillet 12, 1847, p. 777.) It need hardly be observed

that this process could not be made available in practice. Admitting the facts as stated, the assigned difference between 6 and 10 per cent. may disappear by further observations. A want of chemical accuracy might lead to serious mistakes. The process, however, is open to this objection:—If respiration has been fully performed, this will be sufficiently evident from the state of the lungs; and if imperfectly performed, as the change is alleged to depend on the respiratory act, the result of an analysis would not remove the difficulty.

8. *The specific gravity of the lungs.*—The specific gravity of the lungs is greater before than after respiration; for although the organs become absolutely heavier by the establishment of the process, this is owing, not to the air, but to the additional quantity of blood received into them. The air thus received so increases the volume of the lungs as to more than counteract the additional weight derived from the blood, and thus apparently to diminish their specific gravity. Under these circumstances they readily float on water. From several experiments, I have found that the specific gravity of the lungs before respiration, *i.e.* in the fœtal condition, varies from 1·04 to 1·05. They are about one-twentieth part heavier than their bulk of water. After respiration, the specific gravity of the lungs with the air contained in them, I found in one experiment to be 0·94; *i.e.* the organs were about one-seventeenth part lighter than their bulk of water. The introduction of a small quantity of air will render these organs buoyant in water, and an alteration in the volume of the lungs sufficient for this purpose would not be perceptible to the eye. It will be understood that the specific gravity of the substance of the lungs is unchanged; the organs are rendered only apparently lighter by the air contained in their cells, on the same principle as a distended bladder. Hence it follows that the apparent diminution of specific gravity will take place whether the air be derived from respiration, artificial inflation, or putrefaction. It is on this property of the lungs that the application of what is termed the *hydrostatic test*, or the *docimasia pulmonaris*, is founded—a subject which may be appropriately considered in another chapter.

Conclusions.—The general conclusions which may be drawn from the contents of this chapter are:—

1. That a child may be born alive and be criminally destroyed before it has breathed.

2. That the presence of any marks of putrefaction in the uterus proves that the child must have come into the world dead.

3. That the characters accompanying certain marks of violence may occasionally show that the child was living when the violence was applied to it.

4. That there are no certain medical signs by which a child which has not breathed can be proved to have been living when it was maltreated.

5. That a new-born child may be destroyed by the prevention of respiration during delivery.

6. That the proof of respiration shows that the child has *breathed*; not that it has been *born alive.*

7. That by taking together the colour, volume, consistency, absolute weight, and buoyancy of the lungs we may be able to draw an inference whether the child has or has not breathed.

8. That the lungs increase in weight according to the degree to which respiration is established, and not necessarily according to the period which the child has survived birth.

9. That no reliance can be placed upon the test of Ploucquet, or the proportionate weight of the lungs to the body.

10. That no reliance can be placed either upon the relative quantity of blood in the pulmonary vessels, or upon the relative proportion of fat contained in the pulmonary tissue, as evidence of respiration having been performed.

CHAPTER 70.

MODE OF EMPLOYING THE HYDROSTATIC TEST—INCORRECT INFERENCES—SINKING OF THE LUNGS FROM DISEASE OR ATELECTASIS—LIFE WITH PARTIAL DISTENSION OF THE LUNGS—LIFE WITH PERFECT ATELECTASIS OR ENTIRE ABSENCE OF AIR FROM THE LUNGS—ERRONEOUS MEDICAL INFERENCE FROM SINKING OF THE LUNGS —FLOATING OF THE LUNGS FROM EMPHYSEMA AND PUTREFACTION—EFFECTS OF PUTREFACTION IN AIR—GENERAL CONCLUSIONS.

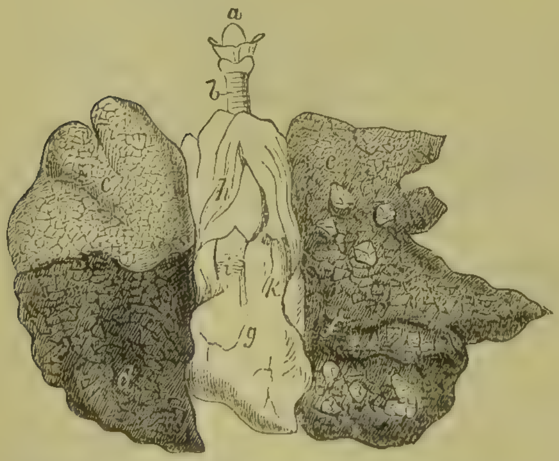
Mode of employing the hydrostatic test.—The hydrostatic test has been long known, and various opinions have been entertained relative to its efficiency and value. Many of the objections that have been urged to its use, appear to have arisen from a mistaken view of the evidence which it is capable of furnishing. The term 'test' is decidedly improper, since there are numerous cases in which it does not enable us to decide whether a new-born child has come into the world living or dead. It is, however, for the sake of convenience, here retained. When the hydrostatic test is properly applied, and with a full knowledge of the exceptions to which it is exposed, it will afford in many cases good evidence whether a child has or has not respired. The mode of performing the experiment is extremely simple. Having removed the lungs from the chest, they should be placed, still connected with the trachea and bronchi, upon the surface of distilled or river water. If they sink it should be noted whether the sinking takes place rapidly or slowly. If they both sink, the two lungs should be tried separately; for it is sometimes found that one, commonly the right, will float, while the other will sink. Supposng that both lungs sink, it will then be proper to divide each into twelve or ifteen pieces, and place these pieces separately on water. If, after this, they all sink, the inference is, that although the child may have lived and survived its birth, *there is no evidence of its having breathed.* On the other hand, the organs when placed on water may float: it should then be noticed whether hey float high above the surface, or at or below the level of the water; someimes they indifferently float or sink. These differences will lead to a conclusion respecting the degree to which respiration has taken place. It will now be proper to separate the lungs, and determine whether the buoyancy is due to one or both. Each lung should be divided, as before, and each piece eparately tried. If all the pieces float, even after firm compression, we have good evidence, *cæteris paribus*, that respiration has been very perfectly performed. Should any of the divided portions sink in water, either before or after compression, our opinion should be modified accordingly. Some have recommended that the lungs should be placed on water with the heart and hymus gland attached; but there appears to be no good reason for this, ince it is as easy to form an opinion of the degree of buoyancy possessed by he lungs, from the readiness with which they float, as by observing whether or not they have the power of supporting these two organs.

Such, then, is the method of employing the hydrostatic test in cases of infanticide. With regard to its use in medical jurisprudence, it should be observed that the floating of the lungs in water is not, as it is often incorrectly epresented to be, a proof that a child has been *born alive*: nor is the fact of heir sinking in water any proof that a child was *born dead.* The floating, nder the limitations to be now described, proves only that a child has *breathed*, the sinking, either that it has *not breathed*, or breathed but imperfectly. The fact of a child having been *born* living or dead, has, strictly speaking, no relation to the employment of the hydrostatic test. There are, indeed, cases of infanticide which may be readily established without resorting to this test:

all that the law requires is proof of a child having been born living,—whether this proof be furnished by the state of the lungs through the hydrostatic test, or in any other manner, is of no moment. The signs of life are commonly sought for in the lungs, because it is in these organs that the changes produced by a new state of existence are first perceived; but this examination may be dispensed with, when the woman confesses that the child was born alive—when others have seen it manifest life by motion or otherwise after its birth; or, lastly, in cases where, without being seen, it has been heard to cry. The crying of a child has been admitted as evidence of live-birth on several trials for infanticide; although, as it is elsewhere stated, a child may utter a cry and die before its body is entirely born. Among the *objections* which have been urged to the employment of the hydrostatic test, we have first to consider those which concern the sinking of the lungs in water.

SINKING OF THE LUNGS FROM DISEASE OR ATELECTASIS.

It is said that the hydrostatic test cannot show whether a child has or has not survived its birth, because the lungs of children that have lived for a considerable period have been observed to sink entirely in water. In some instances this may depend on disease, tending to consolidate the air-cells, as *hepatization* or *scirrhus*—in others, on *œdema* or *congestion*: but these cases can create no difficulty, since the cause of the lungs sinking in water would be at once obvious on examination. The hepatized portion of lung may be known by the firmness with which it resists cutting with a knife, as also by the fact that it is impossible to distend it artificially with air. On the other hand, there are cases in which the lungs appear healthy and unaffected: all that we can perceive is, that they retain their fœtal condition. This is a very different state from that of hepatization, because the lungs may, in this case, be made to receive air by artificial inflation. It is remarkable that life should continue for many hours, and sometimes even for days, under such a condition; but the occasional existence of this state of the organs in a living child is placed beyond all dispute; the explanation of the causes upon which it depends—how it is that a child may live and breathe for hours or days, and no signs of respiration are discovered in its body after death, is, however, involved in great difficulty. The researches of Dr. E. Jörg, of Leipzig, have thrown some light upon the subject: and these may probably lead the way to other discoveries in this obscure department of physiology. Some of Dr. Jörg's views are peculiar. He considers that the act of parturition, as well as the duration of the process, has a material influence upon the system of a child; and that these conditions serve to prepare it for the efforts which it has to make in performing respiration. ('Die Fötuslunge,' Grimma, 1835.) Supposing the first inspiration made by a child to be, from any cause, feeble or imperfect, then the organs will become only



Atelectasis of the lungs in a new-born child from Jörg.

a b Larynx and windpipe. *c* The right lung, the upper and lighter portion containing air. *d* The darker and lower portion in a state of atelectasis (uninflated). *e* The left lung. *f* A portion of this lung in a state of atelectasis with small patches of a lighter shade which have received air. *g* The heart. *h* The thymus gland. *i* The aorta. *k* The pulmonary artery.

partially distended; the remaining portions will preserve their fœtal condition. Dr. Jörg considers this as a positively diseased state of the lungs in the new-born child, and he has given to it the name of *atelectasis* (ἀτελής, 'incomplete;' ἔκτασις, 'expansion'). It may proceed from various causes. He considers that children that are born after an easy and rapid delivery are subject to it; and thus it may be found in a mature, as well as in an immature child. Any cause which much weakens the vital powers of a child before its actual birth, may give rise to the occurrence of this imperfect expansion of the lungs. In this way it may be due to long-continued pressure on the head during delivery, or to bleeding from the cord. All the causes of asphyxia in a new-born child, will, when operating only in a slight degree, also produce this atelectasic condition. When a part of the lung is, in the first instance, distended with air, the child may not afterwards acquire sufficient strength to fill the remaining portions; it may thus live on for some hours or days, respiring at intervals, and becoming occasionally convulsed, in which state it will probably sink exhausted and die. Jörg has remarked, that those portions of the lung which are not speedily distended with air, become afterwards consolidated or hepatized, so that all traces of their cellular structure are lost. The length of time which a child survives will depend upon the degree to which its lungs have become dilated. This condition of the lungs is sometimes to be clearly traced to the diversion of the blood from these organs, by reason of the ductus arteriosus or foramen ovale remaining open after birth.

Life with partial distension of the lungs.—It is not necessary that the whole of the lungs should have received air, in order that a child should continue to live even for several months after its birth. Some years since, I met with the following case, which will serve to illustrate this statement. A child aged six months had been, it was supposed, destroyed by suffocation. Upon opening the thorax, the viscera were found healthy; but the whole of the inferior lobe of the right lung was, so far as regarded colour, density, and structure, precisely like the lungs of a fœtus,—no air having ever penetrated into it. It had become developed in size, but its cellular structure was perfectly destroyed. When the whole of the lung was placed in water, it floated; but when the inferior lobe was separated, it immediately sank to the bottom of the vessel. I have no doubt that this was a case of partial atelectasis, such as it is described by Jörg. This portion of the lung had not received air in the first instance; and it had become afterwards consolidated or hepatized, so that it could not be inflated. The illustration at page 904 represents the condition of the lungs described by Jörg under the name of atelectasis.

Dr. Albert met with a case, in which a child died *thirty-six hours* after its birth, having been attacked by convulsions at intervals during that time. On inspection the whole of the right, and the lower portion of the left lung were found to be in their fœtal condition, and they immediately sank when immersed in water. There was no diseased appearance in the organs, and the undistended portions were easily filled by blowing air into them. (Henke's 'Zeitschrift,' 1837, vol. 2, p. 422.) M. Dépaul found that in many cases in which children had died suddenly after breathing for several hours or days, there was no other morbid appearance to be perceived than an unexpanded condition of a large portion of the lungs. ('Med. Gaz.' vol. 39, p. 283.)

Life with perfect atelectasis, or entire absence of air from the lungs.—It is quite necessary for a medical jurist to be aware that this state of the lungs, which is here called *atelectasis*, is by no means unfrequent among new-born children, although attention has been only of late years drawn to the subject. When no portion of air is found in the lungs of a child, there is no test by which such a case can be distinguished from one in which the child has come into the world dead. These cases of atelectasis are ordinarily set down as exceptions to a general rule; but I believe they are more common than some medical jurists are inclined to admit. In examining the body of a child, the history of which is unknown, it is proper that the possible occurrence of such cases should be well borne in mind. It appears to me not improbable, that many such come yearly before coroners in this country; and that they are dismissed as cases of still-born children, notwithstanding that marks of violence are often found upon the bodies. If, as it has been already observed, the lungs sink in water, this fact alone is commonly regarded as sufficient evidence of still-birth. This is assuredly putting the most humane interpretation on the circumstance, and so far the result is not to be objected to; but we should take care, in carrying out this principle, that we do not throw obstacles in the way of a judicial inquiry, and lead to the concealment of crime. Professor Bernt met with an instance in which a seven-months' child died *two hours* after birth; and when its lungs were divided and placed in water, every fragment sank. Remer has reported another, in which the lungs sank in water, both entire, as well as when divided, although the child had survived its birth at least *four days*. (Henke, 'Lehrbuch der G. M.' p. 374.) In this case the navel-string separated naturally before death. Orfila found, in a child which had lived *eleven hours*, every portion of the lungs, when divided, to sink on immersion. In three other instances, in which the children survived birth four, six, and ten hours, the lungs also sank when divided; two of these were mature. ('Méd. Lég.' vol. 1, p. 375.)

Dr. Vernon attended a healthy woman, who was delivered of a child at about the *sixth month* of her pregnancy. The child was born before his arrival, and he heard it crying strongly from under the bed-clothes as he entered the room. After removal from the mother, the child cried at intervals, and it was observed that its chest rose and fell as in ordinary breathing. It lived five hours, and it then appeared to die from feebleness and exhaustion. It was a female child and very small; the body weighed 2 lbs. 13 oz., and its length was 12¾ inches; the eyelids were adherent. The lungs were of a purplish-red colour, and slightly overlapped the bag of the heart: they sank in water both entire and when divided into small pieces; they were not crepitant, and broke down under firm compression: there was no appearance of air-cells in a section of the lungs when examined by the microscope. The ductus arteriosus and foramen ovale were in their fœtal state. ('Lancet,' Feb. 3, 1855, p. 121.) In these cases the respiration is what is called bronchial, or confined to the upper part of the air-passages. The following is another instance of atelectasis. The child was born prematurely at the *seventh month*, and cried strongly. The breathing became slower and slower, until the death of the child, four hours after birth; but during this time it cried at intervals. The head and face were livid, and remained so after death. The heart continued to beat after respiration had ceased. The blood on inspection was found fluid and black; the lungs were of a dark colour, like the liver, and they sank in water even after an attempt had been made to inflate them with a blowpipe. ('Med. Times and Gaz.' May 23, 1857, p. 523.) Metzger supposed that premature children alone were likely to present this anomaly—*i.e.* of continuing to live after birth without leaving any clear signs of respiration in their lungs.

In July 1849, Mr. Hurd of Frome attended a woman who gave birth to a female child, as she believed, in the eighteenth week of her pregnancy. The child was supposed to be dead and placed aside. Some time afterwards Mr. Hurd's attention was called to it by some of the attendants, who had observed convulsive movements of the body. These continued for half an hour, and the action of the heart was evident to the eye from the pulsation it communicated to the chest as well as to the hand. There was no visible respiration at any time, but there can be no reasonable doubt that this child was *born alive.* In October 1852, in attending another woman, Mr. Hurd noticed that the navel-string ceased to pulsate eight minutes before entire delivery. The child was born apparently dead: it was corpse-like in appearance, and its limbs were flaccid. By the aid of a hot bath and inflation of the lungs continued for twenty minutes, the lips acquired a slight colour, and there was a feeble sigh. After the inflation had been continued for three quarters of an hour the lips and face became more tinged, and respiration was established. This case clearly shows that the act of respiration is not necessary to the presence of life in new-born children. Any physician insisting on this proof, would have pronounced this child to have been still-born or dead, thirty minutes after its birth, and have given a certificate accordingly; while after forty-five minutes he would have been equally prepared to give a certificate that the same child was born alive! The child was alive and well at the time the case was published, *i.e.* nine years after the birth. There can be no doubt that from this erroneous doctrine respecting the necessity of evidence of *respiration* at birth as a proof of life, some children are consigned to certain death, when by the application of proper means the latent might have been converted into active life. On the other hand, children whose lungs sink in water may have been criminally destroyed.

It is a curious fact that, in some instances, life may be indicated by the action of the heart, when owing to some accident the lungs cannot act. Efforts at respiration may be made, but the lungs will be found to contain no ir. Mr. Cann of Dawlish (a former pupil) met with the following case of breech-presentation, in which the child appeared to breathe before its head was born. As the head was large, considerable force was required in order o remove it. Artificial respiration was resorted to for twenty minutes after ts birth, and, although the beating of the heart was felt during sixteen minutes of that time, no breathing occurred. On inspection, it was found hat the vertebræ of the neck were dislocated, and there was great effusion of blood around the spinal cord. The lungs were of a bluish-grey colour, as in he fœtal state. They were not crepitating, and did not float on water.

I may add to these instances two which have occurred under my own bservation. In one, the case of a mature male child, the lungs sank in water, lthough the child had survived birth for a period of *six hours.* In the other, he case of a female twin, the child survived *twenty-four hours*; and after leath the lungs were divided into thirty pieces; but not a single piece floated; howing therefore that, although life had been thus protracted, not onehirtieth part of the structure of the lungs had received from respiration ufficient air to render it buoyant. ('Guy's Hospital Reports,' No. 5, p. 355.) n the latter instance no particular remark was made during life respecting he breathing of the child. These cases show most clearly that buoyancy of he lungs is not a necessary consequence of a child having lived and breathed or some time after birth. Probably, had this been a case calling for medicoegal enquiry, the lungs would have been cut to pieces; the sinking of the ivided pieces in water, either before or after compression, would have been et down as negativing the act of respiration, and, unless other strong evidence ad been forthcoming—the fact of the child having survived its birth. Here, gain, we perceive the necessity of not hastily assuming that a child had been *orn dead*, because its lungs *sink* in water. There may be no good medical vidence of such a child having lived after birth, but assuredly the mere inking does not warrant the common and positive dictum, that the child was ecessarily dead when born; it would be as reasonable to pronounce, in a uestion of poisoning, that the fact of an individual having died from poison was negatived by the non-discovery of a poisonous substance in the stomach of the deceased.

Hydrostatic test not applicable to such cases.—It must be apparent, on reflection, that cases of this description are beyond the reach of the hydrostatic as well as of all other tests applied to the respiratory organs; because the lungs do not receive and retain a sufficient quantity of air to give buoyancy after death, although the children may have lived some hours. The hydrostatic test is no more capable of showing that such children as these have lived than it is of indicating from what cause they have died. Facts of this kind demonstrate that a passive existence may be for some time maintained under a state of the respiratory process not to be discovered after death. In the opinion of some these cases form a serious objection to the hydrostatic test; but it is difficult to understand how they can affect its general application—or why, because signs of respiration do not always exist in the lungs of children that have lived, we are not to rely upon them when they are actually found. Poison is not always discoverable after death in the stomach of a person who has taken it; but this does not prevent a medical jurist from searching for it, and, under proper precautions, relying upon its discovery as evidence of poisoning in another case. These singular instances prove that we are greatly in want of some fact to indicate life after birth, *when the signs of respiration are absent.* Until we discover this we must, of course, make the best use of that knowledge which lies at our disposal; taking care to apply it to those cases alone to which experience shows it to be safely adapted. In the meantime, the common inference that a child had been born dead because its lungs sink in water, is never likely to implicate an innocent party; it can only operate by sometimes leading to the liberation of the guilty.

Erroneous medical evidence from sinking of the lungs.—From the cases already reported, it is a fair subject of consideration whether a great error is not committed by those medical practitioners who pronounce children to have been born dead, merely because the lungs contain no air and readily sink when placed on water. This, it is true, is the common opinion, but it is not warranted by observation. We are only entitled to say, in all such cases, that there is *no evidence* of a child having breathed or lived. Many might be disposed to consider it an unnecessary degree of refinement to hesitate to express an opinion that a child was born dead when its lungs sank entirely in water, because certain cases have occurred wherein these characters have been possessed by lungs taken from the bodies of children that have survived their birth many hours. To those inclined to adopt this view I would say, the answer to such a question is of far greater importance in a medico-legal than in a medical point of view. In the latter case, no responsibility can be attached to the expression of the opinion commonly adopted; in the former case, however, when the question refers to child-murder, a serious responsibility is incurred by a practitioner, and he can only guard himself from unpleasant consequences by basing his evidence on carefully observed facts. If a child can live for six or twenty-four hours without receiving into its lungs sufficient air to allow even one-thirtieth part of their substance to float, it is clear that such a child may be the subject of a murderous assault; and if a medical practitioner, losing sight of this fact, should declare, from the lungs sinking in water, that the child *must* have been *born dead*, his assertion may afterwards be contradicted, either by circumstances, by the testimony of eyewitnesses, or by the confession of the woman herself. He will be required, perhaps, to revise his opinion; and he will then find that the fact of the lungs sinking in water is rather a want of evidence of life after birth, than a positive proof of a child having been born dead. It cannot be denied that the sinking of the lungs is a strong *presumption* in favour of still-birth, but it is nothing more ;—it is not, as it is often set down, a direct or positive *proof* of the child having been born *dead*. There are many cases reported which show that this is not an unnecessary caution. Meckel relates two instances in which the lungs sank in water, but the women respectively confessed that they had destroyed their children: according to the general rule, these children must have been born dead, and murder could not have been committed! ('Gerichtl. Med.' p. 365.) For other examples of a similar kind I must refer to the following journals: 'Ann. d'Hyg.' 1837, vol. 1, p. 437; also, 1841, p. 429; Henke's 'Zeitschrift,' 1840, vol. 27; 'Erg. H.;' 'Brit. and For. Med. Rev.,' Jan. 1842, p. 250. The cases there reported appear to me to convey a warning to medical witnesses on the danger of expressing an opinion not strictly warranted by medical facts, and which must be in such cases merely speculative.

A case of some interest in this point of view was communicated to the 'Medical Gazette' by Dr. Davies, of Hertford. In November 1847 he was required to examine the body of a child found under suspicious circumstances. Its body was in a pasteboard-box of small size, with the lid turned inside out, and on the top there was a quantity of mould. The body was found buried in a garden. It appeared on enquiry that there had not been exactly a concealment of birth on the part of the mother, who was an unmarried woman. The body was thirteen inches long from crown to sole; the eyelids were adherent; the testicles (it was a male child) had not descended; its body weighed one pound and three-quarters. It was ascertained that it had been buried a fortnight, which accounted in some degree for the lightness of its weight in proportion to its length, and for a slight separation of the cuticle from some parts of the arms: the body looked otherwise healthy. The age was probably about seven months. On examining the lungs, they were found to be quite firm, like the liver; *they sank in water, both wholly and in parts.* The right lung was of a dark brown mahogany colour, but the upper lobe of the left was of *rather a lighter colour* than any other part of the lungs. However, this lobe sank immediately upon being placed on water. The evidence at the inquest proved that the child was not only *born alive*, but that it had lived *ten minutes* at least, and perhaps longer, after birth. It appears that an elderly woman, living close by, was sent for, and when she arrived she found the child, with the placenta attached to it, in the close-stool. She noticed that the child moved its arms; she therefore took it up with the placenta, and wrapped it in flannel. It continued to move its limbs for *ten minutes*, according to her account, *but it uttered no cry.* When the child ceased to move, she divided the cord seven inches from the body, and tied it into a knot. ('Med. Gaz.' vol. 40, p. 1022.)

It has been recommended that medical jurists should consider as *dead* every child that has not breathed, *i.e. whose lungs sink in water*; but they who give this advice at the same time admit that children may come into the world living without breathing, and the law holds, under the decision of its expounders, that respiration is only *one*, and not an exclusive, proof of life. In order to establish life, or even live-birth, respiration need not always be proved, either in civil or criminal cases. (See p. 797.) A medical jurist would, therefore, be no more justified in asserting that all such children were necessarily born dead, than that they were born living: and in stating what is the plain and obvious truth, it is not possible that his statement can ever be the means of involving an innocent person. It is certain, however, in departing from the truth, and stating what is contrary to well-known facts, that when the lungs of a child sink in water, it is safe and just to consider such child as having been born *dead*, he is incurring the risk of exculpating really guilty person; for it cannot be too strongly borne in mind, that a woman is not now charged with murder, merely because the lungs of her child float or sink in water, but because there are upon its body marks of violent injuries apparently sufficient to account for the death of a new-born child, or there are strong moral presumptions of her guilt. (See 'Ann. d'Hyg.' 1836, vol. 2, p. 362.)

FLOATING OF THE LUNGS FROM OTHER CAUSES THAN RESPIRATION.

Another series of objections has been urged to the hydrostatic test, based on the fact that the lungs may receive air and acquire buoyancy from other causes than respiration. These causes are two: *putrefaction and artificial inflation.* It was supposed, that the lungs of a still-born child might become emphysematous from a compression of the sides of the thorax during delivery; but it is difficult to understand how in this way air should be extricated from these organs any more than it would be from the liver under similar circumstances. The truth probably is, that what has been described as *emphysema* of the lungs in still-born children was nothing more than partial or imperfect respiration performed during delivery. In examining the bodies of many still-born children, I have never met with any appearance resembling what has been described as a state of emphysema independently of respiration and putrefaction. It may be proper, however, to state that, according to some observers, emphysema of the lungs may be produced under the following circumstances:—the thorax of the child is compressed in passing the outlet; the lungs within are thereby compressed; and if this compressing force be suddenly removed, as by the passage of the thorax, the elasticity of the parietes will cause the chest to expand, and air, it is presumed, will enter as a necessary consequence by aspiration. The simultaneous compression of the abdomen might aid in the entrance of the air. ('Lancet,' May 20, 1837; also, June 17, 1837.) It is contended that not only may respiration take place during birth, but that even the lungs of a *dead* fœtus may become thus mechanically inflated, and respiration be thereby simulated.

This opinion appears to be founded on an erroneous view of the condition of the thoracic viscera in the chest. The lungs, before air has entered into them, are as dense as the liver. If they are compressed they may become elongated, but when that pressure is removed, they will, if the child be dead, simply return to their original fœtal condition. To suppose that they would expand and receive air, is to suppose that the reaction of the thoracic parietes is greater than the force with which they have been compressed. But what is to carry the thorax of a dead child beyond the point at which equilibrium is restored? Besides, this would not suffice to distend the air-cells, which are yet coiled up, as it were, and condensed. If this theory were correct, scarcely a child would be born without having air in its lungs. In experimenting on this subject, I have never observed the least portion of air to enter: the air-cells of the lungs do not, therefore, appear to be in the condition of compressed spiral strings, which such a theory would represent.

Floating of the lungs from putrefaction.—The lungs of a still-born child, when allowed to remain in the thorax, are slow in undergoing putrefaction; but, nevertheless, they sooner or later acquire sufficient air to render them buoyant in water. This form of gaseous putrefaction may even take place in the lungs of a child which has died in utero. One instance of the kind is recorded by Dr. Albert (Henke's 'Zeitschrift,' 1837, vol. 2, p. 179), in which the child was cut out of the uterus in a putrefied state, and its lungs floated when placed on water. It has been also alleged, that the formation of air may take place in the lungs from putrefaction, without this being indicated by change in colour, smell, or other properties of the organs; but admitting that this may occur, it can create no difficulty in the investigation.

When the lungs are putrefied, this will be determined, in general, by putrefaction having extended throughout all the soft parts of the body. The organs, according to the degree of putrefaction, will be found soft, of a dark green or brown colour, and of a highly offensive odour; the serous membrane covering the surface will be raised in large visible bladders, from which the air may be forced out by very moderate compression. It has been remarked that, under the same conditions, gaseous putrefaction takes place as rapidly in the liver, heart, and thymus-gland of a new-born child, as in the lungs. We should, therefore, examine the general conditions of the body; the distension of the lungs with gas from putrefaction cannot be easily overlooked or mistaken for the air of respiration. The answer to any objection founded on the putrefied state of these organs, must at once suggest itself. It is impossible that any well-informed medical witness can expect to obtain satisfactory evidence from experiments on lungs in such a condition. He should at once abandon the case, and declare that in regard to the question of respiration, medical evidence cannot establish either the affirmative or the negative. The fact of his not being able to give the evidence required, cannot be imputed as a matter of blame to him; because this is due to circumstances over which he has no control. In a case of poisoning, the appearances after death in the viscera may be entirely destroyed by putrefaction; but no practitioner would think of looking for proofs when the circumstances rendered it utterly impossible for him to obtain them.

A case may possibly occur wherein the characters presented by the lungs will be such as to create some doubt whether the buoyancy of the organs is due to putrefaction or respiration, or, what is not unusual, whether the putrefied lungs may not also have undergone the changes produced by respiration. The facts may be apparently explicable on either assumption. Other facts, under a proper nvestigation, may serve to remove any doubt. (See case by Dr. Francis, 'Med. Gaz.' vol. 37, p. 460; also Casper's 'Vierteljahrschrift,' 1864, vol. 2, p. 37.) n one or two instances which have come to my knowledge, there has been on he part of medical practitioners a disposition to pass beyond the line of safety, nd to draw the same inferences of respiration from putrefied lungs as would be orrectly drawn from those which are recent. The gases of putrefaction are enerally distributed in large and superficial bladders beneath the pleural memrane. The gases themselves have an offensive odour. The air of respiration may be seen in the minute cells of the lungs, either by the eye or with the aid f the microscope; but it is proper when the lungs are clearly putrefied not o strain medical evidence too far. The case should be allowed to fail for want of evidence rather than receive support from medical opinions based upon an xamination of lungs in this condition. These remarks apply only to lungs on which experiments are made in order to determine the question of breathing. The body may be putrefied, but the lungs may not share in this condition. n this case the results of experiments might be admissible as evidence.

It has been recommended on these occasions that the witness should lean to he side of the prisoner,—in other words, he should give an opinion, that the hild suspected to have been murdered had not breathed. This advice is qual to recommending a witness to take upon himself the duty of a jury, nd virtually to acquit a prisoner upon a doubt existing in his own mind, in espect to only *one* portion of the evidence adduced against her. The evil fects of following this kind of advice are well shown by a case reported in Henke's 'Zeitschrift' (1843, vol. 1, p. 102, Erg. H.), in which an opinion was improperly given by a medical witness, that the child, the whole of the rgans in whose body were in an advanced state of putrefaction, was born *ead*; and the prisoner afterwards confessed that it had been born *living*! his shows that it is always better to leave a doubtful case as we find it, than to express a positive opinion on one side or the other, when this opinion can never amount to more than a conjecture. If a witness were simply to assure a jury, that medical evidence could not solve the question whether the child had lived or not—if he were to assert, what is really the fact, that his experiments would not allow him to say whether the child had or had not breathed,—it is certain that no innocent person would ever be convicted or a guilty person acquitted, upon his evidence. It is for a jury only to judge of guilt from *all* the circumstances laid before them; but it is assuredly not for a medical witness to prevent further investigation, and put an end to the case, by leaning to the side of the accused when there is really a doubt upon his mind. It is his duty to state that doubt, and leave the decision of guilt or innocence in the hands of the Court.

Conclusions.—The general conclusions which may be drawn from the contents of this chapter, respecting the application of the hydrostatic test in cases of infanticide, are the following:—

1. That the hydrostatic test can only show whether a child has or has not breathed,—it does not enable us to determine whether a child has been born living or dead.
2. That the lungs of children that have lived after birth may *sink* in water, owing to their not having received air, or to their being in a diseased condition.
3. That a child may live for a considerable period when only a portion of the lungs has been penetrated by air.
4. That a child may survive birth even for twenty-four hours, when no part of its lungs has been penetrated by air.
5. Hence the sinking of the lungs (whether whole or divided) in water is not a proof that a child has been *born dead.*
6. That the lungs of children which have not breathed and have been born dead, may float in water from putrefaction or artificial inflation.
7. That the lungs as situated in the chest undergo putrefaction very slowly,—that if but slightly putrefied, the air may be easily forced out by compression, and if much putrefied, either the case must be abandoned, or other sources of evidence sought for.

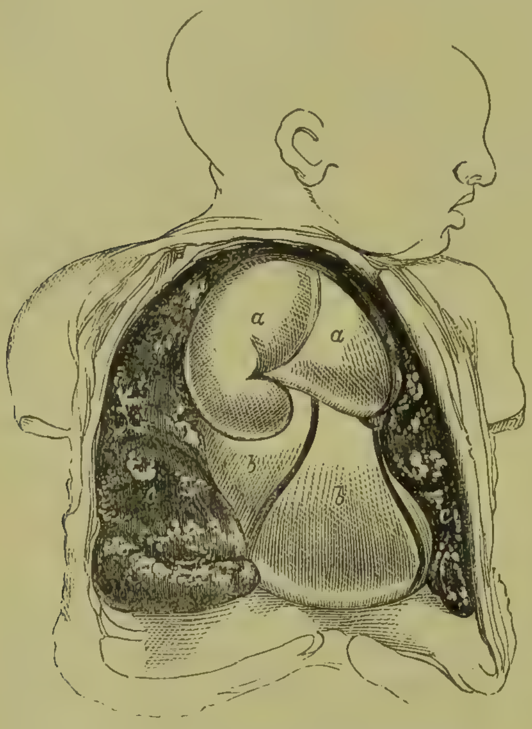
CHAPTER 71.

FLOATING OF THE LUNGS FROM ARTIFICIAL INFLATION—INFLATION DISTINGUISHED FROM PERFECT RESPIRATION—NOT DISTINGUISHABLE FROM IMPERFECT RESPIRATION—DOUBTFUL CASES—RESULTS OF COMPRESSION—IMPROPER OBJECTIONS TO THE HYDROSTATIC TEST—SUMMARY—RESPIRATION BEFORE BIRTH—VAGITUS UTERINUS—RESPIRATION A SIGN OF LIFE, NOT OF LIVE-BIRTH—THE KILLING OF CHILDREN WHICH BREATHE DURING BIRTH NOT CHILD-MURDER—GENERAL CONCLUSIONS.

Floating of the lungs from artificial inflation.—It has been alleged that the lungs of a still-born child may be made to assume, by artificial inflation, all the characters assigned to those which have undergone respiration. Thus, it is said, a child may not have breathed, and yet the application of the hydrostatic test would in such a case lead to the inference that it had. It will be seen that the force of this objection goes to attack directly the inference derivable from the presence of air in the lungs. There is only one form under which it can be admitted, namely, as it applies to lungs which have been inflated while *lying in the cavity of the chest.* Any experiments performed on inflation after their removal from this cavity, can have no practical bearing since in a case of infanticide we have to consider only the degree to which the lungs may be inflated by a person who is fairly endeavouring to resuscitate a still-born child. The difficulty of inflating the lungs of a new-born child is too well known to require to be here adverted to; the greater the violence used, the less likely is the air to pass into these organs, but it rather finds its way through the gullet into the bowels. Dr. Albert, a writer on the subject, denies that the organs, while lying in the chest, can be so filled with air, either by the mouth or by means of a tube, as to be rendered buoyant in water. In performing this experiment several times, he never found a trace of air in the air-cells; and he contends that medical jurists have begun at the wrong end (den Gaul von hinten aufgezäumt), in endeavouring to seek for answers to an objection before they had ascertained that such an objection could have, practically speaking, any valid existence. (Henke's 'Zeitschrift,' 1837, vol. 2, p. 390.) M. Depaul has still more recently found that it requires great force to inflate the lungs, and that their resiliency was sufficient to expel the greater part of the air thus introduced. ('Med. Gaz.' vol. 39, p. 283.)

Having had several opportunities of examining the lungs of children in which inflation had been resorted to, not for the express purpose of creating an objection to the hydrostatic test, but with the *bonâ fide* intention of resuscitating them, I may here state the results. In some of these instances a tube had been used, and in others the mouth. In the first case it was found, on inspection, that only about one-thirteenth part of the structure of the lungs had received air. In the second, no part of the lungs had received a trace of air, although inflation had been repeatedly resorted to; the air had passed entirely into the abdomen. In a third, attempts were made for upwards of half an hour to inflate the organs; but, on examination, not a particle of air was found to have penetrated into them. In a fourth, no air had entered the lungs, and in a fifth, although a small portion had penetrated into the organs, it was readily forced out by compression. In repeatedly performing experiments on dead children, the results have been similar; the lungs, after several attempts, were found to have received only a small quantity of air. Thus, then, it would appear, that the lungs of a new-born child may be inflated *in situ*, although with some difficulty, and that the quantity of air which they receive under these circumstances is generally small. If the efforts at inflation be continued for some time in the dead body, and the tube be violently introduced into the larynx or trachea, or if the organs be inflated after removal from the chest, with the express intention of causing them to resemble respired lungs, the result is different: but this is not the mode in which the objection can possibly occur in a case of infanticide,—a circumstance which appears to have been strangely overlooked by some of those who have examined this alleged objection to the hydrostatic test. It is not likely that a woman, if able to perform the experiment at all, would be capable of doing more than a practised accoucheur; and the probability is, that she would, in general, altogether fail in the attempt. One case is recorded, in which a woman, recently delivered, is stated to have succeeded in artificially inflating the lungs of her child ('Meckel, Lehrb. der G. M.' 368; see also 'Ed. Med. and Surg. Jour.' vol. 16, p. 374); and another, in which this defence was urged on the part of a woman, is reported by Dr. Von Siebold, of Göttingen (Henke's 'Zeitschrift der S. A.' vol. 3, 1845). The child, in this instance, was found with its head cut off, and the lungs contained air. The inconsistency of the woman's statement as to the mode in which she inflated the lungs was clearly proved, and the examiners did not hesitate to give a decided opinion that the air found in the lungs had been derived from the act of respiration, and not from artificial inflation. This case shows that, when a theoretical objection of this kind comes to be tested practically, it ceases to present any difficulty. It may happen, however, that another person may inflate the lungs, and, if the mother has been secretly delivered, she may be wrongly charged with murder. (See case, Casper's 'Vierteljahrsch.' 1859, vol. 2, p. 38.) A midwife here attempted to revive a child by breathing into its lungs after the removal of its body from the soil of a privy; but the circumstances of the case were well known from the statement of the midwife. Other instances of inflation are reported by Dr. Dommes, in the same journal, 1860, vol. 2, p. 131.

But let it be admitted that the lungs have been artificially inflated; in this case, they would resemble, by their partial distension with air, and other physical characters, those of children which had imperfectly breathed. Like them, they may float on water; but on cutting them into pieces, some of these would be found to sink. If the pieces be firmly compressed either by means of a folded cloth or between the fingers, they will lose their air and sink; so that in fact there are no physical means of distinguishing artificially inflated lungs from those that have imperfectly breathed. Experiment has repeatedly shown that when respiration has been feeble, and no artificial inflation resorted to, the air may be forced out of the lungs by moderate compression, and the portion so compressed will sink in water. If the compression be produced under water, bubbles of air may be seen to rise through the liquid. The results have been exactly the same when the lungs were inflated artificially as they were lying in the chest. (See 'Guy's Hospital Reports,' No. V.; and for some good remarks on this subject by Dr. Christison, see 'Edin. Med. and Surg. Jour.' vol. 26, p. 74.)



View of the Lungs artificially inflated *in situ*.

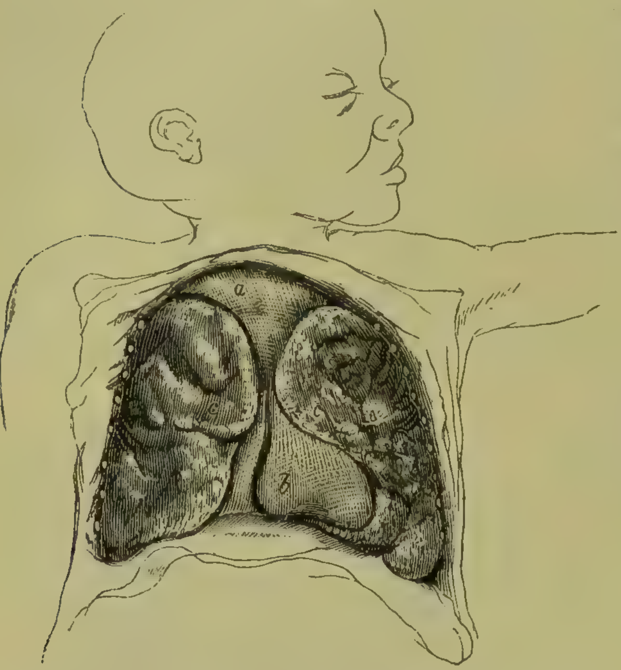
a a The thymus gland.
b b The heart in its pericardium.
c c The lungs, the lighter portions of the engraving representing the unequal diffusion of air through the air-cells.

Artificial inflation compared with perfect respiration.—If respiration has been *perfectly* established, and the lungs are well filled with air, it is impossible so to expel this air by compressing the divided portions of the organs as to cause them to sink in water. If they have been only imperfectly distended by the act of respiration, they retain more or less of their fœtal condition, and the air may be forced out of them to a sufficient degree to cause them to sink in water. It has been hitherto considered that in all cases of artificial inflation as distinct from the act of respiration, the air introduced could be expelled by compression of the lungs, and hence that a difference existed between lungs which had perfectly breathed and those which had been simply inflated. My own experience is in favour of this view. In many experiments performed on the lungs of still-born children which had been artificially inflated, I have found that firm compression of them in a folded cloth sufficed to expel the air, which was in general only very partially distributed in isolated patches through the substance of the organs. My colleague, Dr. Hicks, referred to me a case that occurred in his practice, which shows that this distinction is certainly not in all cases available, and that too exclusive a reliance upon it, vithout full consideration of other circumstances, may mislead a medical vitness. He delivered a woman of a full-grown child; it was still-born, and here was no effort at respiration. An attempt was made to resuscitate he child, but unsuccessfully, by blowing air into the lungs through a atheter. On inspection, the lungs were observed to be of large size, but hey did not present the usual appearance of lungs which had breathed. lthough about three-fourths of the organs had received air by inflation, they vere of a pale-fawn colour, like the thymus gland. The air was contained in he minute air-cells. They floated on water as well as all the pieces (fifteen r sixteen) into which they were divided. When compressed between the ngers under water, small bubbles of air escaped; but no amount of compresion short of destroying their structure caused these pieces to sink. A fact f this kind, although perhaps exceptional, shows that the non-expulsion of r from lungs by compression must not be regarded as an absolute proof of espiration. It must be taken with other circumstances, *e. g.* absolute weight nd colour, as a fact, to show that the child has either breathed, or has had s lungs perfectly inflated in a *bonâ fide* attempt to restore life after birth, ither by the mother or by some person present at the birth.

In respect to lungs thus submitted to compression, the results are the same hether the child has breathed for a short or a long time after its birth, proided only the act of breathing has been complete. In one instance I found it mpossible to expel the air when a child had lived to make no more than one or vo respirations, and had died before it was actually born. On this occasion it as found necessary, in order to effect delivery, to destroy the child while its ead was presenting. It lived, however, a sufficient time after the protrusion f its head, with the greater part of the brain destroyed, to cry loudly for an nstant. The general appearance of the body showed that it had attained to he full period of gestation. On opening the chest, the lungs were seen proecting slightly forwards over the sides of the pericardium. They were of a ght-red colour, but not crepitant under the finger. They had the external hysical characters which these organs are known to acquire on the first stablishment of respiration; but the absence of crepitation proved that the ir-cells were not completely filled. The colour of the external surface as throughout uniform—a circumstance which I have never witnessed in ngs that had been artificially inflated, except when the inflation had been rried to its fullest extent out of the body. Then, however, there is, comonly, distinct crepitation. When removed and placed on water, the lungs oated freely; and, on being separated, both appeared equally buoyant. Each ng was next divided into sixteen pieces, and every piece floated. In dividing em, it was observed that the colour was uniform throughout their substance, ut there was no sense of crepitation or crackling under the knife; and the cells which the air was diffused could not be seen. The pieces were then subcted to forcible compression for some time in a folded cloth. The cloth was ptured by the force employed; yet on removing the pieces, and placing em on water, they all continued to float. A portion of air had, undoubtedly, een forced out, but not sufficient to deprive any of them entirely of their uoyancy. The compression was carried to the farthest possible limit constently with the preservation of the organic structure of the lungs. From is we learn that in some instances two or three respirations may suffice to ve great buoyancy to the lungs, and so distribute the air that it cannot be rced out by compression.

It must not, however, be supposed that, in all children which have lived but second or two to respire, similar results will be obtained. The respiration an instant may distend the lungs of one child, as much as respiration connued for several hours would those of another. The time which a child has survived its birth does not allow us to predict to what degree its lungs will be found distended on inspection, or what the results of experiments on these organs will be. A child may have breathed feebly, and have died either in a few minutes or hours, or not until many days have elapsed after its birth. There is, of course, no definite boundary between the perfect and imperfect distension of the lungs, but by the latter condition we may understand that state of the healthy organs in which they contain only sufficient air to render them buoyant in water; and from the slight difference in their specific gravity and that of water, a small quantity will suffice for this. In these cases, the colour, volume, weight, and consistency of the lungs are scarcely changed from the fœtal condition.

It is proper to observe, that the results obtained by submitting the lungs to compression in cases of respiration and artificial inflation, have been very different in the hands of experimentalists equally competent. Some state that they have been able to force out the air in both instances, others in neither case. These discrepancies may depend either upon the different degrees of pressure employed, or upon the actual degree of distension of the lungs. The fact of their existence shows, at least, that the lung-tests cannot be safely trusted in the hands of persons who have not been used to such investigations. It appears to me that there has been a great deal of misplaced discussion on this subject. One case should at least be adduced, in which a woman charged with child-murder has been or can be hypothetically exposed to any risk of conviction, from the admission that air cannot by compression be forced out of artificially inflated, or that it can be expelled from respired, lungs. I am not aware that there is a single instance in our law-records of such an objection being raised upon any but merely hypothetical grounds, in opposition to all the circumstances of the case. It might be imagined, however, from the discussions among medical writers on the necessity for certain and infallible means of distinguishing artificial inflation from respiration, that every woman tried for child-murder had made the praiseworthy attempt to restore a still-born child, although circumstances may show that she had cut its throat, severed its head, or strangled it, while circulation was going on! (See case 'Prov. Med. Jour.' April 23, 1845.) If compression be trusted to as a criterion, without a proper regard to other facts, a practitioner not used to such cases may undoubtedly be easily led into error; but he may be equally deceived if he trust what has been proposed as a substitute for compression—*i. e.* a mere physical inspection of the lungs.



View of the Lungs imperfectly distended with air by respiration. The child died soon after it was born.

a The thymus.
b The heart in its pericardium.
c c The lungs, of which the lighter portions of the engraving represent those parts which contain air.

Artificial inflation not distinguishable from imperfect respiration.—It must, however, be admitted, that there are no means of distinguishing *feeble respi-*

ration from *artificial inflation.* The physical characters of the lungs will be unaltered; and compression may, in either condition, destroy their buoyancy. In a case of this kind, I apprehend, the only course left open to a medical witness is, to state to the jury that the evidence derived from experiments on the lungs left it uncertain whether the child in question had breathed, or had had its lungs artificially inflated. The jury will then know how to return their verdict; for it must be remembered, they have always circumstances, as well as medical opinions, to guide their judgment; and it is upon the *whole*, and not upon a part, of the evidence laid before them that their verdict is founded.

It is singular that the occasional difficulty of distinguishing artificial inflation from respiration, whether perfect or imperfect, should have been represented as a serious objection to the employment of the hydrostatic test. Even admitting, in the few instances in which such a defence on the part of a prisoner is possible, that a practitioner is unable to distinguish one condition from the other, this becomes purely a point for the consideration of a jury: it cannot affect the general application of the hydrostatic test. Examples of this sort of difficulty are by no means uncommon in the practice of medical jurisprudence. Many instances might be adduced of medical evidence being rendered doubtful by circumstances wholly independent of the skill of the practitioner, and over which he has had no possible control. In the determination of any single point in a case of child-murder, whether it relates to live-birth or the actual cause of death, a doubt may arise; the question relative to the respiration of a child is not exempted from this rule; but it would be the height of inconsistency to contend that, because certain means of investigation will not always enable us to express a positive opinion, we should never have recourse to them. I presume that, in the present day, no practitioner would trust to the floating of the lungs as a sign of breathing, before he had ascertained that the air contained in them could not be expelled by compression. The charge against an accused party is not likely, therefore, to be sustained by medical evidence of the respiration of the child, unless the child have actually breathed; but it is possible that, owing to a want of evidence to characterize feeble respiration, a really guilty person may escape upon the bare assumption that the lungs might have been artificially inflated. The mischief to be apprehended is not, then, as it has been often alleged, that the employment of this pulmonary test may lead to the condemnation of an innocent, but rather to the acquittal of a guilty, person.

In reference to this objection, there are, it appears to me, only two cases which may give rise to some doubt respecting the source of the air contained in the lungs of a new-born child.

Doubtful cases.—1. In the case of a child that has not breathed, the lungs may be disproportionately heavy, weighing nine hundred to one thousand grains, and they may have been artificially inflated in the attempt to resuscitate t. Unless, in this case, the air was expelled by compression, an inference might be hastily drawn, that the child had probably breathed. The error ould be removed only by circumstantial evidence; which, however, is generally sufficient to remove a speculative objection of this kind. But unless the œtal lungs were highly congested, diseased, or of extraordinary size, it is not kely that they would weigh so much as is here supposed. These doubtful ases may always be suspected to exist when, with *considerable absolute eight, the lungs contain very little air.* Let us, however, consider what would e its practical bearing on the question of child-murder, supposing the case ot to be cleared up by any of the methods above suggested. 1st. The fact f respiration would not be clearly proved, because the great absolute weight f the lungs, without their structure being permeated with air, amounts to nothing. 2ndly. Although the proof of respiration might not be made out, this would not show that the child was born dead; for we know that a child may live many hours, and yet no evidence of life may be derived from an examination of the lungs (p. 905, *ante*). 3rdly. Admitting that there was proof of the child having lived after its birth, whether there were evidence of respiration or not, the cause of death would have still to be made out: and unless this be clearly traced to the wilful and malicious conduct of the prisoner—proofs of which are not likely to be derived from the body of a child whose lungs she has innocently inflated—she must be acquitted. Thus, then, it is difficult to understand how, in the hands of one who has attended to the subject of infanticide—and no others ought to be allowed to give medical evidence—this objection, on the ground of inflation, can lead to any difficulty whatever in practice. Such a case as that which I have here supposed actually occurred to me in June 1842. A male child, weighing upwards of twelve pounds, died during delivery in a difficult labour. It gave no signs of life when born, and there was no pulsation in the cord. Its lungs were artificially inflated in the attempt to resuscitate it. The organs weighed nine hundred and ninety-four grains. They were slightly crepitant and floated on water, but gentle pressure by the fingers caused them to sink. It was clear that the increased weight depended on their great size, and not on any change produced by respiration. They contained but a small quantity of air, which was easily expelled by pressure. In another case, which I examined in June 1847, the child was born dead. The body was well developed, and the lungs weighed 748 grains. These organs were inflated as they were lying in the chest. On moderate compression, when divided, they immediately sank in water.

2. We will now take the converse objection. A child may live and breathe, and its lungs weigh much under the average of respired lungs, *i. e.* about seven hundred grains. In a case like this, unless the air resist expulsion by compression, a converse mistake might be made, and we should pronounce a child that had really breathed and survived birth to have been still-born and to have had its lungs artificially inflated. This might happen in numerous cases of imperfect respiration after birth, did we not know that the sinking of the lungs, whether containing air or not, and whether this air be expelled by compression or not, does not necessarily prove that a child was born dead. It can only show, under the most favourable circumstances, that it has either not breathed, or breathed but imperfectly. The sinking of the lungs may take place in a child that has survived birth and has really been murdered; but in such a case there may be no proofs of life; and therefore a person actually guilty of a crime would be discharged for want of sufficient medical evidence to convict. This, however, could no more justify the entire abandonment of medical evidence in such cases, than it could of general evidence; because this, like evidence which is purely medical, is but too often insufficient to bring home guilt to the really guilty. The objection, therefore, on the ground of artificial inflation, when closely examined, is more speculative than real. Admitting, as some contend, that there is no positive criterion to distinguish this condition from respiration in any degree, it is difficult to conceive a case in which the objection could be sustained; and, if sustained, it never could lead, in the hands of proper witnesses, to the inculpation of the innocent: unfortunately for society, it would only add another loophole to the many which, through the necessary forms of law, now exist for the escape of the guilty.

Improper objections to the hydrostatic test. Summary.—In concluding these remarks upon the objections to the hydrostatic test, it may be observed that medical practitioners have differed much at different times in their ideas of what it was fitted to prove. About fifty years ago, it would seem that this test was regarded by some as capable of furnishing evidence of murder! Thus we find Dr. Hunter asking the question, 'How far may we conclude that the child was born alive, *and probably murdered by its mother*, if the lungs swim in water?' Later authorities, and, indeed, many in the present day, assert that the test is capable of proving whether a child has been *born alive* or not! From what has already been stated, as well as from the most simple reflection on the circumstances accompanying the birth of children, I think it must be evident that the hydrostatic test is no more capable of showing whether a child has been *born alive or dead* than it is of proving whether it has been murdered or has died from natural causes. The majority of those who have made experiments on this subject have only pretended to show, by the use of this and other tests, whether or not a child has *breathed*,—they merely serve to furnish in many cases good proof of life from the state of the lungs; and slight reflection will render it apparent that in no case are they susceptible of doing more. Even here their utility is much restricted by numerous counteracting circumstances, a knowledge of which is essential to him who wishes to make a practical application of the facts connected with them. (See 'Edin. Med. and Surg. Jour.' vol. 26, p. 365.)

If asked to state in what cases the pulmonary tests are capable of assisting a medical jurist, the answer, it appears to me, would be :—1st. They will clearly show that a new-born child has lived, when, during its life, it has *fully and perfectly respired.* Cases of this description form a certain number of those which come before our Courts of Assize. To them the most serious objections are applicable; and the few which might be made to the medical inferences are not difficult to answer. 2ndly. They will allow a witness to say, that the lungs must have received air either by respiration, or by artificial inflation. These are the cases in which a child has died soon after birth, and where the respiratory changes are but imperfectly manifested in the lungs. They probably form a large proportion of those which fall under the jurisdiction of the criminal law. It might be considered, that the qualifications in the inference here drawn would neutralize its force; but it must be remembered, that there are few instances of actual and deliberate child-murder wherein artificial inflation could become even a possible defence for an accused person. So unusual is this kind of defence, that among the numerous trials for infanticide which have taken place in this country for many years past, I have not been able to meet with a single instance in which it was alleged, as an objection to the medical evidence derived from the buoyancy of the lungs, that the prisoner had inflated them in order to resuscitate her child. The reason is obvious; had such a defence been attempted, the whole of the circumstantial evidence would at once have set it aside. When, in the suspected murder of an adult, a medical man swears that a fatal wound was such that the deceased might have inflicted it on himself, or that the prisoner might have produced it, he is placing the jury in a position very similar to that in which he places them in a case of child-murder, when he says that the child might have breathed, or its lungs might have been artificially inflated. How would a jury decide in the two cases? Assuredly, by connecting certain facts with which a medical witness is not concerned, but which may, in their opinion, satisfactorily supply the place of what is deficient in his evidence. It is not for him to speculate on the probabilities of respiration, or of artificial inflation; but it is for them to consider whether an accused party was or was not likely, under the particular circumstances of the case, to have resorted to an experiment of this nature. It has been suggested that some person might inflate the lungs of a dead child, in order to raise a charge of murder against its mother; but this suggestion presupposes, on the part of a criminal, a profound knowledge of the difficulties of medical jurisprudence; and even then the question of *murder* does not happen to depend merely on the presence of air in the lungs. Such a case is very unlikely to present itself; indeed, its occurrence is no more probable than that in poisoning it should be considered a good defence that some person might have introduced poison into the body by injections after death. The circumstances of the case will commonly furnish a sufficient answer to such hypothetical views.

The hydrostatic test ought not, therefore, to be lightly condemned, or rejected upon a speculative objection, which, in nine-tenths of the cases of child-murder, could not possibly exist. Let it be granted to the fullest extent, that a conscientious medical jurist cannot always draw a positive distinction between the effects of respiration and artificial inflation on the lungs; still a jury may be in a situation to relieve him from this difficulty. In short, it would be as reasonable to contend that all murderers should be acquitted because homicidal are not always to be distinguished from suicidal wounds, as to argue that all cases of infanticide should be abandoned because these two conditions are not to be known from each other by any certain medical signs. If juries do frequently dismiss such cases, it is, I apprehend, to be ascribed rather to their great unwillingness to become the means of administering what they consider to be severe laws, than to their want of power to balance and decide on the probabilities laid before them. If the pulmonary tests were wholly set aside, it is easy to conceive what would be the consequences. Let us suppose that a new-born child is found, under suspicious circumstances, with its throat cut: we are called upon to admit that it is impossible for medical evidence to establish whether the child has lived or not, and therefore we are to decline making an inspection of its body. But this would be the same as declaring that child-murder could never be proved against an accused party, and that new-born children might henceforth be destroyed with impunity! It appears to me that conduct of this kind, on the part of a medical witness, would be wholly unwarrantable; for we may sometimes acquire, by an inspection, as great a certainty of respiration having been performed, and therefore of a child having lived, as of any other fact of a medico-legal nature. Cases of poisoning often give rise to greater difficulties to a medical jurist; as where, for example, he attempts to found his opinion of the cause of death on symptoms alone or on appearances in the dead body. But we may put the question in this light. In the body of a healthy full-grown child, which has but recently died, we find the lungs filling the cavity of the chest, of a light red colour, spongy, crepitant beneath the finger, weighing at least two ounces, and, when divided into numerous pieces, each piece floating on water, even after violent compression. Is it possible in such a case to doubt that respiration has been performed? If there is no certainty here, it appears to me that medical experience is but little fitted in any case to guide us in our enquiries. It would be difficult to point out an instance in which an affirmative medical opinion would be more surely warranted by the data upon which it was founded.

Respiration before or during birth.—It has been already stated that the pulmonary tests are fitted to prove only whether a child has or has not *lived to breathe*. Neither the hydrostatic nor any other test can positively show that the body of a child was entirely *born alive* when the act of breathing was performed. As this is a subject which generally gives rise to some discussion in cases of child-murder, I shall here make a few remarks on it. 1st. Respiration may be performed while the child is in the uterus, after the rupture of the membranes—the mouth of the child being at the os uteri. This is what is termed *vagitus uterinus*; its occurrence, although extremely rare, seems to me to rest upon undisputed authority. 2ndly. A child may breathe while its head is in the vagina, either during a presentation of the head or of the breech. This as been termed *vagitus vaginalis.* It is not very common, but it must be set own as a possible occurrence. 3rdly. A child may breathe while its head is rotruding from the outlet: in this position respiration may be as completely et up in a few moments by its crying, as we find it in some children that have ctually been born, and have survived their birth for several hours. This is he most usual form of respiration before birth. In the *vagitus uterinus* or *aginalis* the lungs receive but a very small quantity of air; in respiration fter protrusion of the head the lungs may be sometimes found moderately vell filled, although never, perhaps, possessing all the characteristic properties f those which have fully respired. The well-known occurrence of respiration nder either of these three conditions strikingly displays the fallacy of making his process, as some have done, the certain boundary of extra-uterine life. p. 801.) A child may breathe in the uterus or vagina, or with its head at the utlet, and die before its body is born: the discovery of its having respired would t, therefore, be any sort of proof of its having enjoyed what has been termed extra-uterine life.' (For a well-marked case of this kind, see 'Med. Gaz.' ol. 38, p. 394; and another, communicated to me by Dr. Crothers of Coy, will e found in 'Guy's Hospital Reports,' October 1850, p. 231.) The death of child which has breathed in the uterus or vagina, from natural causes before ts entire birth, is a possible occurrence; but its death from natural causes efore birth, after it has breathed by the protrusion of its head from the outlet, s an unusual event. All that we can say is—it may take place; but the death f a child under these circumstances would be the exception to a very eneral rule. Oberkamp, in four successive deliveries of the same female, bserved that the children breathed before delivery, but died before they were orn. A case of this kind also occurred to Diemerbroek. (See Meckel, Lehrbuch der G. M.' p. 367; Beck's 'Med. Jour.' vol. 1, p. 498; also Edin. Med. and Surg. Jour.' vol. 26, p. 374.) The cases reported by Beck, f which there are three, lose much of their value from the fact that the lungs ere not examined.

The following case, communicated to me by Dr. Hicks, occurred in the bstetric Charity of Guy's Hospital. A woman was delivered of a large hild, weighing thirteen pounds. The forceps were required in order to deliver e head. After the head was born, and before the entire extrusion of the ody, the child breathed four or five times. There was then a total cessation f respiration, as well as of pulsation of the heart for some time (apparent eath), but these were restored by artificial inflation of the lungs, when e child was entirely born. It was alive when last heard of. If we suppose at this woman had been privately delivered of an illegitimate child, and ere had been no assistance at hand, a practitioner, relying upon the act of espiration as a proof of live-birth, might pronounce such a child to have een born living. According to the dictum of the late Professor Casper of erlin, if we only find air in the lungs of a new-born child, such a child must ave been born alive. ('Gerichtl. Medicin,' vol. 1, p. 710.)

Respiration a sign of life, not of live-birth.—The hydrostatic test is only pable of determining that *respiration has taken place*: it cannot show hether this process was established during birth or afterwards. The fact of child having the power of breathing before it is entirely born, does not erefore constitute the smallest objection to its employment; although upon is ground, we find the use of it in any case, denounced by many eminent embers of the medical and legal professions. Thus, Archbold says, 'Very tle confidence is placed in this test as to the lungs floating, particularly if e child were dead any length of time before the experiment was made' Criminal Pleading,' p. 367); Mathews speaks of the test as being 'quite ploded' ('Digest,' p. 251); and Jervis makes the same remark ('On

Coroners,' p. 127). It is obvious that most members of the law who have treated this subject have adopted, without sufficient examination, the statements of Dr. William Hunter. This author observes: 'A child will commonly breathe as soon as its mouth is born or protruded from the mother; and in that case may lose its life before its body be born, especially when there happens to be a considerable interval between what we may call the birth of the child's head and the protrusion of its body. And if this may happen where the best assistance is at hand, it is still more likely to happen when there is none—that is, where the woman is delivered by herself.' ('On the Uncertainty of the Signs of Murder in the case of Bastard Children,' p. 33.)

Dr. Hunter here exposes, in plain language, the fallacy of trusting to signs of respiration alone as evidence of a child having been *born* alive. The truth of his remarks is, in the present day, generally admitted; and if, among medico-legal writers, we find some still treating of respiration as a certain proof of live-birth, it is from their not having sufficiently considered the probability of a child breathing and dying before its body is entirely extruded. But we may ask, How does the admission of these views affect a case of deliberate child-murder? A living and breathing child may be wilfully destroyed before its body is entirely born, as well as afterwards; and if the law of England does not contemplate the wilful destruction of a living and breathing child before its entire birth as a crime, this omission cannot be imputed as a fault to the medical jurist; nor can it at all diminish the real value of the hydrostatic test as furnishing indisputable evidence of *life*. Most persons might consider the crime of murder sufficiently made out when the medical evidence showed that a child had lived, and that it was *living* when *criminally destroyed*. If, however, this does not constitute infanticide in law, and evidence be further insisted on, to set forth *where* the child was actually living when murdered—whether half protruding from the vagina, or altogether external to the body of the mother—then the fact of breathing before birth is an objection rather to the principles of the law than to the test used to determine the presence of life. In a case tried a few years since, in which a child had been found with a ligature firmly tied round its neck, the medical evidence showed clearly that it had breathed; and the whole of the appearances in its body were such as to leave no medical doubt that it had died by strangulation. The judge, in charging the jury, said, 'If they were of opinion that the prisoner *had strangled her child before it was wholly born, she must be acquitted of the murder*!' The prisoner was acquitted. However we may regard the question of the utility of pulmonary tests, we must look upon that law as but very imperfectly adapted to its purposes which makes the proof of murder to rest, not upon the actual and wilful destruction of a living child, but upon the precise moment which a murderer may select for the accomplishment of the crime. Impunity is thus held out to all offenders, who destroy a living child during the act of birth; but there is an additional evil accompanying the operation of this legal maxim, which seriously affects the medical evidence given on these occasions. It would seem, from cases to be presently related, that the law will assume, until the contrary appears from other circumstances, that the respiration of a child, if proved by the best of evidence, was carried on before it was entirely born. Let the witness, then, in a case of alleged child-murder, ever so clearly establish the fact of respiration and therefore of life, at the time the violence was used, this evidence is not sufficient. He is asked whether he will undertake to swear that the child had breathed *after* its body was entirely in the world. Unless he can go so far as this,—which, for obvious reasons, he can rarely be in a condition to do—it will be presumed that, although the child had breathed, it came into the world dead. Hence, we perceive, a legal shield is effectually thrown around those who may ave been really guilty of destroying their children immediately after birth. Under any moral consideration of the circumstances, it appears to me imposible to admit that a woman who kills her child in the act of birth is less guilty f murder than she who chooses the moment of its entire expulsion to destroy t; and any such distinction, carried to its full extent, must virtually go to he abrogation of the law for the suppression of child-murder. It is quite ecessary that medical witnesses should know what they are required to prove n these occasions; and the following cases will, perhaps, serve to place this atter in a stronger light.

The killing of children which breathe during birth not child-murder.—In the ase of *Rex* v. *Poulton*, good medical evidence was given to show that the hild was living when the violence was offered to it. Of three medical itnesses who were called, the first said, in answer to questions put to him: It requently happens that a child is born as far as the head is concerned, *and eathes*, but death takes place before the whole delivery is complete. My pinion in this case is, that the child had breathed, but I cannot take upon yself to say that it was wholly born alive. The second said that death ight have occurred when the child was partly born, if no medical man was resent to assist in the delivery. The third witness said: It is impossible to tate when the child respired; but there is no doubt from the condition of he lungs, when they were examined, that the child had breathed: children ay breathe during birth. (Chitty, 'Med. Jour.' 412.) The evidence here iven shows that the witnesses were intelligent men; and that they had duly eflected upon that which the hydrostatic test is really capable of proving. The judge held that this medical evidence was not sufficient: 'something more was required than to show that a child had breathed in the progress of its irth; it must be proved that the *whole body* of the child was brought nto the world.' (See 'Mathews's Digest,' Supp. 25; also Archbold, 'Crim. Plead.' 367.) In *Rex* v. *Simpson*, tried at Winchester in March 1835, Baron urney would not allow the case to proceed against a prisoner, so soon as the edical witness stated that the lungs of the child might have become distended y the act of respiration during birth. In *Rex* v. *Brain* it was held that the hild must be wholly in the world in a living state to be the subject of murder; nd in *Rex* v. *Sellis* (Norfolk Spring Circuit, 1837), Mr. Justice Coltman held hat, to justify a conviction for child-murder, the jury must be satisfied that he entire body of the child was actually in the world in a living state when he violence was offered to it. In relation to an important case of infanticide, ried at the Herts Lent Assizes, 1841 (see 'Guy's Hospital Reports,' April 842), the learned judge (Parke, B.) thus charged the grand jury: 'With repect to all these cases (of infanticide) there is a degree of doubt whether he infant has been *born* alive. The law requires that this should be *clearly roved*, and that the whole body of the child should have come from the body f the parent. If it should appear that death was caused *during delivery*, en you will not find a true bill!' In another (*Reg.* v. *Christopher*, Dorset ent Assizes, 1845), Erle, C.J., drew a distinction between medical (physiogical) and *legal* life. The medical evidence clearly established that the child ad breathed. It was found with its head nearly severed from the body. rle, C.J., directed the jury that, before they returned a verdict of guilty, they ust be satisfied that the child was completely born, that it had an existence *stinct and independent from the mother*, and that it was murdered by her. was possible the child might have breathed without being completely born to the world, and although *this might medically be a live child, it was not one gally.* In law, the birth of the child must be complete. The jury acquitted e prisoner. ('Prov. Med. Jour.' April 23, 1845.) In another case a medical itness was reprimanded for drawing an inference from the application of the hydrostatic test, that the child had been born alive. This case was tried on the Midland Circuit in 1853 (*Reg.* v. *Stevens*), before the late Baron Alderson. The body of the child was taken from a river: it was found in a pillow-case with a stone attached to it. There were several incisions on the throat, and the navel-string had been torn away. The state of the lungs showed that the child had breathed, and it was clearly proved to be the child of the prisoner. The medical witness is reported to have stated during his examination, that he had no doubt the child was born alive; upon which the learned judge reproved him for his rashness, and enquired whether the appearances which he had observed enabled him to say more than that the child had breathed. The witness admitted they did not, and also that the child might have breathed *before* it was completely born. In his summing-up, the learned judge remarked that 'the medical evidence only proved that the child had breathed; but a child may breathe before it is separated from the body of the mother, that is, before it is born, and this child may have died before it was born. We have therefore no certainty of there ever having been a person on whom a murder could be committed.' The prisoner was acquitted.

On a more recent occasion, in *Reg.* v. *Taylor* (Hereford Summer Assizes, 1863), there was evidence that the child, with the murder of which the prisoner was charged, had been heard to cry, and the medical witness properly admitted, in answer to the learned judge, that a child might cry before it was fully born. The jury were then directed to consider whether, under the circumstances, the child was wholly born alive, and if they found it was not born alive, they could not find the prisoner guilty of murder or manslaughter. The jury acquitted her of the charge.

From these decisions it will be seen that it is not sufficient for a medical witness to depose, from the state of the lungs, that the child was alive *at or about* the time of its birth; according to the present views of our judges, it is indispensably necessary for him to prove that the child was *born* alive, or that it was living *after* its body had *entirely* come into the world.

Conclusions.—The general conclusions respecting the employment of the hydrostatic test, to be drawn from the contents of this chapter, are—

1. That the artificial inflation of the lungs of a child born dead will cause them to float in water.

2. That while lying in the chest, the fœtal lungs are not easily inflated, and that the difficulty in inflating them is great in proportion as the child is immature.

3. That lungs artificially inflated while in the chest resemble those organs in which respiration has been only imperfectly established.

4. That in cases of inflation of the lungs in the chest, the air may be generally expelled from the divided portions of lung by firm compression so as to cause them to sink.

5. That the same result occurs with lungs in which respiration has been imperfectly established.

6. That when lungs have undergone perfect respiration, the air cannot be expelled by compression of the divided parts, so as to cause them to sink.

7. That the artificial inflation of fœtal lungs causes no alteration of weight, and as the weight increases in proportion to the degree of respiration, so in healthy lungs, with great buoyancy, there should be great weight if the air has been derived from respiration.

8. That while respiration increases the absolute weight of the lungs, it diminishes their specific weight by leading to the distension of the pulmonary cells with air.

9. That when the lungs are very heavy, and contain but little air, it cannot with certainty be inferred that respiration has been established. The facts, *cæteris paribus*, may be explained by supposing that the lungs were naturally heavy, and that they have been artificially inflated.

10. That we should base our judgment of a child having breathed upon great weight and great buoyancy of the lungs combined,—that the one condition without the other is open to the objection, that the air may not have been derived from respiration.

11. That experiments on fœtal lungs, artificially inflated with air after removal from the chest, have no practical bearing on this enquiry.

12. That the floating of the lungs in water proves, *cœteris paribus*, that a child has breathed either at, during, or after birth: it does not prove that a child was born alive, or that it has died a violent death.

13. That the sinking of the lungs, as a result of the expulsion of air from them by compression, does not necessarily prove that the child was born dead. It merely proves that the air contained in them was derived either from artificial inflation, or from the imperfect establishment of the respiratory process.

14. That the hydrostatic test is not applicable to determine the fact of respiration or non-respiration in all cases of alleged child-murder; but that, with ordinary precautions, it may be safely employed in the majority of such cases.

15. That a child may breathe before, during, or after birth, but the hydrostatic test will not enable us to say, in the greater number of cases, at which of these periods the act of respiration was performed.

16. That respiration is a sign of life, and not necessarily of live birth.

17. That, according to the present state of the law, the killing of a child which breathes *during birth* is not murder.

18. Hence medical evidence is required to show whether a child breathed *after* it was *entirely* born, and whether the act of violence which caused its death was applied to it while so breathing.

These conclusions are here, for the sake of clearness, expressed with brevity. Some of them may require qualification; but for the circumstances which qualify them, the reader is referred to the contents of the chapter.

CHAPTER 72.

N THE PROOFS OF A CHILD HAVING BEEN BORN ALIVE—EVIDENCE FROM RESPIRATION—EVIDENCE FROM MARKS OF VIOLENCE—EVIDENCE FROM NATURAL CHANGES IN THE UMBILICAL VESSELS, THE FORAMEN OVALE, AND DUCTUS ARTERIOSUS—CLOSURE OF THE FORAMEN AND DUCT BEFORE BIRTH—EVIDENCE FROM THE DISCOVERY OF FOOD IN THE STOMACH—DETECTION OF LIVE-BIRTH BY THE APPLICATION OF CHEMICAL TESTS TO THE CONTENTS OF THE STOMACH—GENERAL CONCLUSIONS.

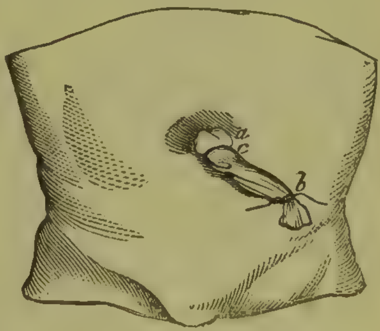
HE great question on a trial for child-murder is, whether the child has been orn alive; and in order to answer this it is necessary to consider what are the roofs of *live-birth* which are available to a medical witness.

Evidence from respiration.—As a general rule, there will be no perceptible ifference in the state of the lungs, whether the act of respiration is performed y a child during parturition or after it is born, provided that its death speedily llows its birth. But should we find that this process has been *perfectly tablished*, *i. e.* that the lungs present all those conditions which have been scribed as characteristic of full and perfect respiration, there is great reason presume that the process, even if it had commenced during birth, must have ntinued after the child was entirely born. This presumption becomes ill stronger when the child is immature; for, generally speaking, such chilen must be born and continue to breathe for many hours after birth, in order that their lungs should present the characters of complete respiration. The process is seldom so established before birth as to give to these organs a feeling of crepitation under pressure; the existence of this character should, therefore, be sought for. A witness who relied upon it as a conclusive proof of respiration *after* birth, might be asked by counsel, whether it were not possible for some children to remain so long at the outlet with the head protruding, as to render the lungs crepitant from frequent respiration *before* entire birth. Admitting the bare possibility of this occurrence, he should endeavour to ascertain whether there were any probable causes thus to protract delivery while the head of the child was in this position; as also, what natural cause could have produced its death when its head was protruding, and when respiration had been so freely performed as to give crepitation to the lungs. The presence or absence of the usual scalp-tumour might throw some light upon the case. If, when present, it did not prove live-birth, it might indicate protracted delivery, and show that the child had been recently living. The late Professor Casper, of Berlin, cuts the Gordian-knot of this difficulty, by assuming, that breathing before birth takes place only in protracted delivery, in which the assistance of an accoucheur is required. In those cases which are likely to give rise to criminal investigations, he assumes that the birth of the child takes place quickly, and that in rapid delivery the child does not breathe until it is entirely born alive. Hence his conclusion is—if in the body of a child (secretly disposed of) the lungs are found to contain air by the hydrostatic test, this air did not enter the lungs at or before birth but afterwards, and that the child was born alive. ('Gerichtl. Medicin,' vol. 1, p. 710.) Such a conclusion is not in accordance with the facts ascertained regarding the act of respiration in new-born children; it may be that they rarely die from natural causes after they have breathed, but that they can breathe during birth is a fact which cannot be disputed (p. 921). Further, there is no test known by which air received into the lungs during birth can be distinguished from that which has entered these organs after the child has been born alive.

Evidence from marks of violence.—If marks of violence, apparently inflicted about the same time, are found on different and remote parts of the body, and these marks bear the characters of those produced during life, it is rendered probable that the whole of the body of the child was in the world when they were caused. Marks of severe violence on one part, as the head or breech, would not always justify such a presumption, because it might be fairly objected that they had been unintentionally produced by the woman in her attempts at self-delivery, and yet the child not have been born alive. It would be for a witness to form an opinion from the circumstances accompanying the particular case, whether they had been thus occasioned. From this it will be seen that, in making an examination after death, it is proper that every mark of injury on the body of a child should be noted down. In March 1848, I was consulted by Mr. Prince, a former pupil, in reference to a case in which the presumption of live-birth rested mainly on the degree of respiration, and the position and nature of certain marks of violence found on the child's body. The child, which was said to have been born dead, was exhumed two days after burial, and eleven days after birth, and the body examined by Mr. Prince. It was full-grown, and not putrefied; the skin pale and free from lividity. There was a clean cut on the right arm, dividing the membrane (fascia) and muscles, as if made by a sharp instrument. The edges were much retracted, and the whole of the wound was of a florid red colour; but there was no swelling or appearance of inflammation. There was a large vesicle (like the blister of a burn) on the scrotum, containing three drachms of a yellow-coloured serum. On the right leg the muscles were exposed for nearly the whole length: the surface of the wound was of a deep scarlet colour, and the margin widely inflamed. It had the appearance as if fire had been applied to the leg, although there was no sign of charring. These facts tended to show that the child was living when the injuries were inflicted; while the nature and situation of the injuries rendered it impossible that they could have arisen from any accident during delivery. The state of the lungs was somewhat remarkable:—the *left* floated freely in water, and there was distinct crepitation in it; the right sank in water,—no portion of it, when divided, was observed to float. From the buoyant and crepitant state of the left lung, there was reason to presume that if respiration had commenced during birth, it had continued afterwards. Mr. Prince, therefore, inferred that the child had been born alive: this inference was corroborated by the appearance of the marks of violence. It is probable that the child did not live long after birth. The air could not have been derived from putrefaction or artificial inflation: therefore the only question here was, whether the child had breathed after its body was wholly in the world. The facts above mentioned justified the inference drawn by Mr. Prince. From a confession subsequently made by the female, it appeared that the child had been born alive, and had cried, but, owing to the injuries inflicted on it, it did not survive birth longer than a quarter of an hour. Although it is a rare circumstance that one lung should become thus fully distended with air, while the other receives none, cases of this kind are on record. Chaussier met with the *left* lung much more distended than the right in the bodies of children that had survived birth some hours. (Capuron, 'Méd. Lég. des Accouchemens,' p. 411.) The general opinion is, that the right lung receives air more readily than the left, owing to the larger size and more direct course of the right bronchial tube.

Evidence from certain changes in the body.—In a child that has been born alive, or has survived its birth for a period of from twelve to twenty-four hours, that portion of the umbilical cord which is contiguous to the abdomen undergoes certain changes: thus it dries and becomes slowly shrivelled, and in from three to five days it separates from the body with or without cicatrization.

The annexed illustration represents the attachment of the umbilical cord or navel-string to the abdomen in a new-born child, the cord having been tied after birth in the usual way. The cord does not separate at the part which is tied, but close to the abdomen. It separates generally within five days, by a process of sloughing, the skin connected with the dead portion of cord presenting a red line, arising from capillary congestion. During the separation of the navel-string the umbilical vessels are gradually closed. According to Billard, the obliteration of these vessels is effected in a peculiar manner. The calibre diminishes as a result of a concentric thickening of the coats, so that, while the vessel retains its apparent size, its cavity is gradually blocked up. A quill would represent the form of the vessel in the fœtal state, and a tobacco-pipe in the obliterated state. It is only by cutting through the vessel that the degree of obliteration can be determined.



Appearance of the Umbilical Cord in a New-born Child.

a Its connection with the skin of the abdomen.
b The point at which the ligature was attached after birth.
c The point at which the cord separates from the body.

The state of the *umbilical cord* has often furnished good evidence of live birth, when the other circumstances of the case were inadequate to furnish decisive proof. In the following instance, for the particulars of which I am indebted to Mr. French, it might have been suspected, but for the state of the cord, that the child had been still-born, and that its lungs had been artificially inflated. In consequence of some suspicion respecting the cause of death, the body of a child had been exhumed soon after burial. It weighed nearly five pounds, and was eighteen inches long; the opening for the navel was exactly in the centre of the body. The hair on the scalp was about an inch in length, and plentiful; the nails reached to the extremities of the fingers and toes. There was no mark of violence about it. The *navel-string had separated* by the natural process, but the skin around was not quite healed. The tendon of one of the muscles of the leg was prominent, and apparently contracted at the instep. The left testicle alone had descended into the scrotum —the right was still in the inguinal canal. This rendered it probable that the child had not quite reached maturity. It was by this peculiarity of the instep that the body of the child was identified. In the first instance the body of another child had been brought from the same burial-ground, but rejected, from the absence of this appearance of the foot.

On opening the chest, the lungs were observed to be situated at the back part and not filling the cavity. They weighed together 861 grains—the right weighing 430, and the left 431 grains. The heart, thymus, and lungs were placed together in water, but they immediately sank to the bottom. The lungs, when separated from the other organs, floated, but with a slight degree of buoyancy. Indeed, this was established by the fact that they sank with the heart and thymus attached. The lungs were cut into twenty-two pieces; three from the apex sank; the remaining nineteen pieces floated, and they were not made to sink by pressure. The foramen ovale was but slightly open and contracted, as well as the ductus arteriosus, to about one-half of the fœtal diameter. The bladder was perfectly empty—the intestines contained only mucus. The conclusions at the inquest were:—1. That the child had been born alive, and had lived certainly not less than three days, and probably longer. 2. That respiration during that time had been but imperfectly established. 3. That in all probability the child had died a natural death. The conclusions were well warranted by the medical facts. Experiments on the lungs were here not absolutely necessary, owing to the state of the umbilical cord. It might have been objected to any inference from the condition of these organs, that the facts were explicable on the supposition of their having been artificially inflated. The case, therefore, furnishes another proof of the ease with which a speculative objection on this ground may be set aside. It was subsequently proved that the child had lived eight days after birth.

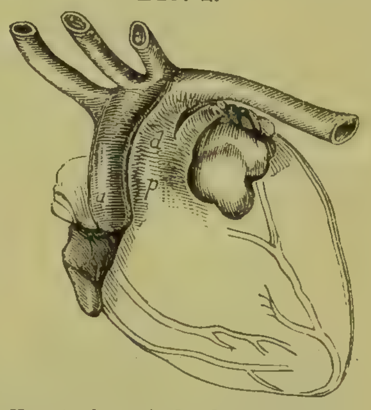
These changes in the umbilical cord, when found, especially its separation and cicatrization, clearly prove that a child has survived its birth, whatever may be the results of experiments on the lungs; but the difficulty is, that they require some days for their production, and in practice it is necessary to procure some sign of survivorship of only a *few minutes*, or at furthest of a *few hours*. The same remark applies to the *exfoliation of the cuticle* in a new-born child: such a condition of the skin can rarely be found in cases of infanticide. The absence of meconium from the intestines, and of urine from the bladder, are not proofs of live-birth, for these may be discharged during birth, and yet the child not be born alive.

State of the skin.—In the greater number of new-born children, the skin has a dark-red colour, probably owing to the first effect of the atmosphere upon it. Within an hour it begins to get of a lighter red, and so it remains for one or two days. According to Dr. Elsässer, it becomes again darker about the end of the second or on the third day, and is then of a brownish-red colour. This lasts for three or four days, unless a yellowness appears from jaundice. It is then more or less yellow. It is about the sixth or seventh day that the skin acquires a reddish-white colour, such as it afterwards retains. (Henke's 'Zeitschrift der S. A.' 1842, vol. 2, p. 223.)

Evidence from changes in the heart and fœtal vessels. Docimasia circulationis.—It has been supposed that the state of the ductus arteriosus, ductus venosus, and foramen ovale would aid a medical jurist in forming an opinion whether a child had survived its birth. In general, as a result of the establishment of respiration, it is found that the communication between the auricles of the heart by the foramen ovale becomes closed; and that the two vessels, after gradually contracting, become obliterated, or are converted into fibrous cords. Whatever may be the conclusions from experiments on the lungs, it has been contended that the closure of the foramen and of these vessels would infallibly indicate that a child had breathed. This inference, however, has been too hastily drawn. Recent researches have shown that there are some serious objections to any conclusions based on the state of these fœtal vessels; their closure, as a natural process, always takes place slowly, and sometimes is not completed until many years after birth. Thus, then, in the generality of cases of infanticide, in which necessarily the child survives but for a short period, no evidence of the fact will be procurable from an examination of the heart and fœtal vessels.

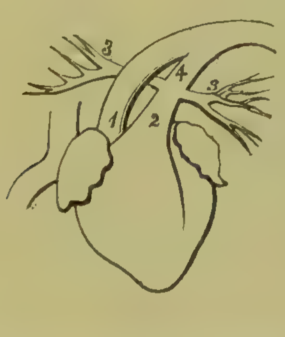
Ductus arteriosus (*Arterial duct*).—The ductus arteriosus is a vessel about half an inch long, which in the fœtus forms a direct communication between the right ventricle of the heart and the aorta; it conveys the larger proportion of the blood from the heart to the aorta without passing through the lungs. So soon as respiration is established its function is at an end, and it then begins to close. In the annexed illustration, the situation and direction of this short vessel are seen: *a* is the aorta; *p* is the pulmonary artery issuing from the right ventricle of the heart; and *d* is the arterial duct, joining obliquely to the under portion of the aorta at the termination of the arch. In figs. 2 and 3 the different parts of the fœtal heart are seen in outline—in fig. 2 as they appear before, and in fig. 3 as they appear after, perfect respiration: 1, the aorta: 2, the pulmonary artery: 3 3, the right and left branches of the pulmonary artery going to the right and left lungs: 4, the ductus arteriosus, short and wide in fig. 2, and in fig. 3 contracted at the end where it joins the under part of the arch of the aorta. Professor Bernt of Vienna, who has made many observations on this subject, drew the following

FIG. 1.



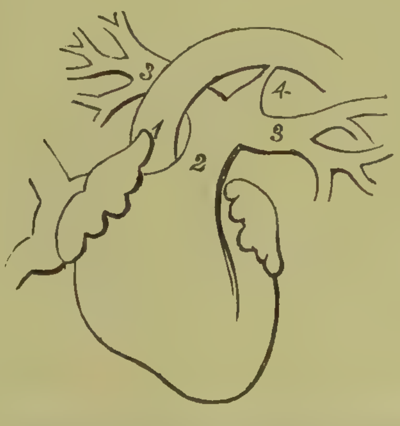
Front view of the heart of an infant five days old (from Sharpey's 'Elements of Anatomy').

FIG. 2.



Heart of the new-born child with the ductus arteriosus in its fœtal state.

FIG. 3.



Heart of the child with the duct undergoing contraction as the result of the establishment of respiration.

conclusions respecting the period required for the closure of the ductus arteriosus in children which have been born alive and have lived after birth:—1. If a child has lived only a *few seconds*, the aortal end of the duct appears contracted, and the vessel, instead of being cylindrical throughout, acquires the form of a truncated cone. 2. If a child has lived for *several hours*, or a *whole day*, the duct becomes again cylindrical, although shortened and contracted in diameter. Its size is about equal to a goose-quill; it is, therefore, much smaller than its root, and about as large as either of the two branches of the pulmonary artery, which have in the meantime become increased in size. 3. If a child has lived for *several days* or a *whole week*, the duct contracts to the diameter of a few lines,—about equal to a crow-quill, while the two branches of the pulmonary artery are equal in size to a goose-quill. 4. The duct is found perfectly closed and quite impervious at a much later period, *i. e.* after the lapse of an uncertain number of weeks or even months. The annexed engravings (figs. 4, 5, and 6) will serve to illustrate the views of Professor Bernt. Fig. 4 represents the condition of the duct before respiration, and (as I have frequently had occasion to observe) after respiration has been established, and the child has died soon after birth; fig. 4 therefore shows the state of the duct in a still-born child, and in a child which has breathed imperfectly. Fig. 5 shows its contraction after perfect breathing, and an increase in the size of the pulmonary arteries (3 3). Fig. 6 represents the closure and obliteration of the duct. The figures of reference are the same as in figs. 2 and 3; but in addition, in figs. 4, 5, and 6, the following references may be pointed out:—5, the situation of the right auricle; 6, the superior vena cava; and 7, the inferior vena cava. Among the exceptional conditions, Bernt remarks that the contraction may be first observed at the cardiac instead of the aortal end. In one instance of a still-born child, that was resuscitated and breathed feebly for a short time, and in which the thymus-gland was absent, the duct was of the size of a crow-quill, as in children which have lived several days. He also states, on the authority of Joseph Schallgrüber, that the duct is sometimes entirely absent. ('Das Verfahren bey der gerichtlich-medicinischen Ausmittelung zweifelhafter Todesarten der Neugebornen,' von Joseph Bernt, s. 67, Wien, 1826; also, 'Systematisches Handbuch der Gerichtlichen Arzneikunde,' s. 275, Vierte Auflage, Wien, 1834.)

FIG. 4.

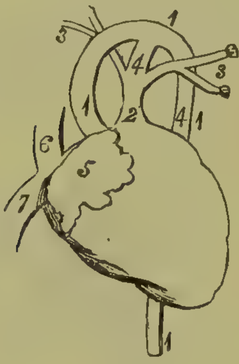


FIG. 5.

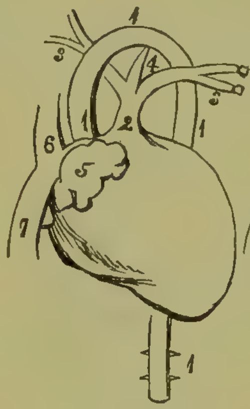
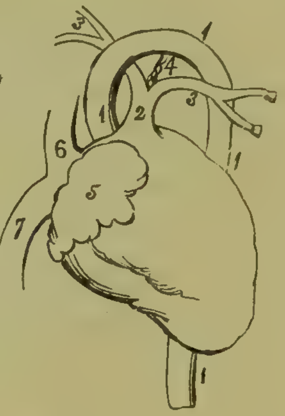


FIG. 6.



The observations of Professor Bernt show that the natural closure of the duct is a comparatively slow process; but his conclusions are open to many more exceptions than those which he admits. Neither in his works, nor in those of other authorities on Medical Jurisprudence, is any case recorded which shows that the duct can become quite impervious from natural causes in a child which has survived its birth only a few hours.

Although the closure may take place as a result of the establishment of respiration, the time of its occurrence after birth is so uncertain as to render any evidence derivable from the non-closure altogether fallacious. I have examined the bodies of several children that have survived birth for some hours, and have not been able to discover any perceptible alteration in the diameter of the duct either at its aortal or cardiac end. In other cases partial contraction has been apparent. As the closure depends on a diversion of blood through the lungs, so it follows that, when respiration is feeble or imperfect, the duct will be found either of its natural patency, or, if closed, the closure must be regarded as an abnormal deviation. In the case of a child that died at the age of ten weeks, the ductus arteriosus was found to be freely open. ('Med. Gaz.' vol. 40, p. 994.) The researches of Dr. Norman Chevers have shown that there are numerous abnormal conditions which may give rise to non-occlusion of the duct. ('Med. Gaz.' vol. 36, p. 190, and vol. 38, p. 961; see also Orfila, 'Méd. Lég.' 1848, vol. 2, p. 212.) From the facts collected by Dr. Chevers, it appears that the duct is liable to become contracted and even obliterated before birth, and before the child has actually breathed. In these cases there has been, in general, some abnormal condition of the heart or its vessels; but this, even if it existed, might be overlooked in a hasty examination: hence the contracted or closed condition of the duct cannot be taken as an absolute proof that a child has been born alive or survived its birth. In January 1847, Dr. Chevers presented to the London Pathological Society the case of a child born between the seventh and eighth months, in which this vessel was almost closed, being scarcely one-twelfth of an inch in diameter, and capable of admitting only the shank of a large pin. The tissues of the duct had altogether an appearance of having undergone a gradual process of contraction; and its state proved that its closure commenced previously to birth. In fact, the child survived only *fifteen minutes*; while, according to Bernt's rule, the medical inference might have been that this child had lived a week. It is important to remark, that in this case the heart and lungs were in their normal or natural state. ('Med. Gaz.' vol. 39, p. 205.) On the other hand, the open or pervious condition of the duct is consistent with the child breathing after birth; it sometimes remains pervious for many years. Dr. Peacock met with an instance in a man æt. 30, in whose body the duct was found pervious, and of sufficient capacity to give passage to a writing-quill. ('Med. Times and Gaz.' Nov. 1861.)

The medical evidence derivable from the condition of the ductus arteriosus in a new-born child was submitted to a rigorous examination in the case of *Frith.* (Ayr Circ. Court of Justiciary, Oct. 1846.) This important case was tried before the late Lord Justice Clerk of Scotland, to whose kindness I am indebted for a full and accurate statement of the evidence. The body of the child was found in a bag which had been buried in the sands on the seashore at Ayr, a little above highwater-mark, with such marks of violence about it as left no doubt that it must have been deliberately and intentionally destroyed. Independently of severe injuries to the throat externally, the mouth and throat nternally were found to be so closely stuffed with tow and other substances hat there was some difficulty in removing them. The body when found was much decomposed; the brain was pulpy, and the cuticle, as well as the bones of the skull, were easily separated. The weight of the body was seven pounds, and the child had the characters of maturity. The prisoner had, beyond doubt, been delivered of a child about three weeks previously to the discovery of this body. It was alleged that this was her child, and she was put on her trial for the murder.

The material question in the case was therefore one of identity. It depended on two sets of facts—ordinary and medical. The bag in which the body was found was part of a cloth-covering of a cushion belonging to the mother and grandmother of the child. This being made out to the satisfaction of the jury, the evidence so connected the prisoner with the dead body, that the medical facts raised in the defence became only of secondary importance. On an inspection of the body the following appearances were met with :—The heart and lungs weighed one ounce ; the latter organs were collapsed; the right lung was considerably decomposed, and sank when placed on water ; the left was of a red colour, firm in texture, and floated on the surface when immersed in a vessel filled with water ; but on pressure there was no crepitation. The right side of the heart was filled with coagulated blood, the foramen ovale being partly open, and the *ductus arteriosus* impervious. The liver was large and of a leaden hue, the ductus venosus almost obliterated, and meconium was found in abundance in the lower bowels. The medical men were of opinion, from the perfect conformation of the child's body and the above-mentioned appearances, that it had been born alive. The circumstantial evidence established that no more than *five hours* could have elapsed from the birth of the child to the time at which its body was buried in the spot where it was subsequently found ; and that, admitting it to have been born alive, there was the strongest reason to believe it did not survive its birth more than *ten minutes.* The results of experiments on the lungs were not alone sufficient to show that the child had been born alive. The organs were light, and not crepitant; the right lung was decomposed, and yet it sank in water, while the left was firm, and floated. The defect in this part of the medical evidence was, however (admitting the identity), removed by the evidence of a man lodging in the prisoner's house, who deposed that he distinctly heard the child cry. He slept in the same room with the prisoner on the morning on which she was delivered, and there does not appear to have been any reason to doubt his testimony.

Under these circumstances, the defence taken up was, that, considering the state in which the ductus arteriosus was found, this could not have been the child of the prisoner, because, if destroyed after being born alive (which was disputed), it must clearly have been destroyed immediately after birth. In that case the ductus arteriosus could not have been found impervious—*ergo*, the body found was not the body of the prisoner's child. It was contended that, according to all previous experience, the duct could not be found impervious in a child which had ceased to live within a *few minutes*, or even a few hours, after birth. One medical witness for the prosecution admitted that it required some days or weeks for the duct to become impervious : but a case was reported by Beck in which it had closed within a day. Another stated that it is generally a considerable time before the duct becomes closed. Medical evidence was given in defence, to the effect that the earliest case of closure was twenty-four hours ; and from the state of the duct in this case, the witness considered that the child must have survived for one day at least, or not much less. Another witness stated that the discovery of the closure in a body would lead him to infer that the child had survived three or four days. According to this evidence the body produced could not have been that of the prisoner's child. The jury, however, found that the child had been born alive, but that murder had not been proven. (For reports of this case, see 'Med. Gaz.' vol. 38, p. 897 ; and 'Edin. Monthly Journal,' Nov. 1846, p. 385.)

It appears from the evidence given at the trial that circumstances quite irrespective of medical testimony proved that this child had been born alive, that it was the child of the prisoner, and that it could have survived its birth only a few minutes. The medical evidence left it undoubted that the child had been destroyed by violence. The facts that the mouth and throat were firmly packed with tow, and that there had been copious effusions of blood in the seats of violence, admit of no other explanation. To what, then, is the early closure of the duct in this case to be referred? So far as I am aware, there is no instance on record of the arterial duct becoming *impervious* within a period of five or six hours (in this case only as many minutes could have elapsed) after birth. Its closure is naturally the result of free and perfect breathing in a healthy child: but the state of the lungs in this instance showed that respiration had neither been full nor complete. It is probable, therefore, that the case was similar to that described by Dr. Chevers, and that there was an abnormal condition of the duct. Either this must be assumed, or the closure must have depended on other causes than perfect respiration: but experience shows, as a general rule, that it proceeds *pari passu* with this process.

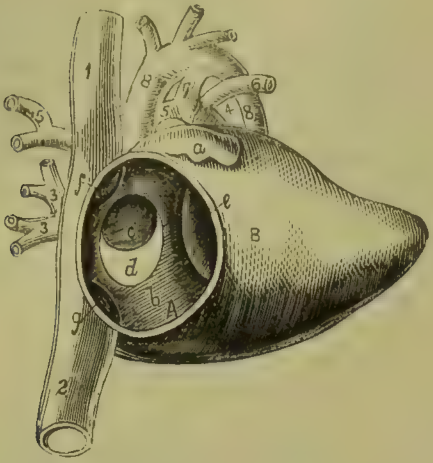
Admitting that this abnormal state of the duct, *i.e.* its closure previous to birth, is in general accompanied by malformation either of the heart or of the great vessels connected with it, yet Dr. Chevers' case, already related, proves that this is by no means a necessary accompaniment. Hence, considering the serious responsibility attached to a medical opinion in a case of child-murder, the better rule will be to place no confidence on a contracted condition of this duct as evidence either of live-birth or of the time during which the child has lived. It can only have any importance, as evidence, when the death of a child speedily follows its birth; and these are precisely the cases in which a serious fallacy is likely to arise, for the contraction or closure may be really congenital, and yet pronounced normal. If a child has lived for a period of two or three days (the time at which the duct naturally becomes contracted or closed), then evidence of live-birth from its condition may not be necessary: the fact of survivorship may be sufficiently apparent from other circumstances. Hence, this species of evidence is liable to prove fallacious in the only instance in which it is required, and the case of *Frith* shows the dangerous uncertainty which must attend medical evidence based on the closed condition of the duct.

Ductus, or canalis venosus.—This is a branch of the umbilical vein which goes directly to the inferior vena cava: there is not, so far as I know, any instance of the obliteration of this vessel previous to birth. When respiration is fully established, it collapses, and becomes slowly converted, in a variable period of time, into a ligamentous cord or band, which is quite impervious. There is no doubt that in those cases in which it is stated to have become obliterated in children that could have survived birth only a few minutes or hours, the mere collapse of the coats has been mistaken for an obliteration of the canal. It is probably not until the second or third day after birth that its closure begins, although nothing certain is known respecting the period at which it is completed. The condition of this vessel, therefore, can throw no light upon those cases of live-birth in which evidence of the fact is most urgently demanded.

Foramen ovale.—This is a large oval opening placed at the lower and back part of the partition between the right and left auricles of the heart. It is considered to attain its greatest size at about the sixth month. It is represented in the illustrations at p. 934 open and closed. Fig. 1—A, cavity of the right auricle laid open: B, situation of the right ventricle: *a*, the right auricle: *b*, the partition between the right and left auricles: *c*, the foramen ovale or opening between the two auricles, partly closed by the valve, *d*. In fig. 2 it will be observed that the valvular membrane *d* almost entirely closes the aperture: *e*, opening into the right ventricle: *f*, opening of the superior vena cava into the upper part of the right auricle: *g*, opening of the inferior vena cava into the lower part of the same auricle: 1, the superior vena cava: 2, the inferior vena cava: 3 3, the two right pulmonary veins: 4, trunk of the pulmonary artery, with its two branches: 5 the right, and 6 the left, pulmonary artery: 7, the arterial duct: 8, the aorta.

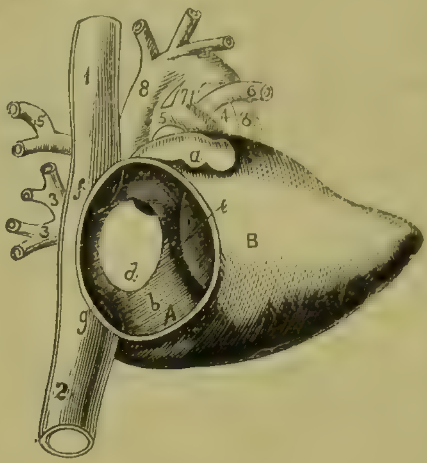
At an early period of fœtal life, there is no valve to the foramen ovale. About the twelfth week the valve rises upon the left side of the entrance of the vein, which thus comes to open into the right auricle. The separation of the two auricles is at the same time rendered more complete by the gradual advance of the valve over the foramen ovale, but the passage nevertheless continues open until after birth.

Fig. 1.



The mature fœtal heart, showing the foramen ovale open before respiration.

Fig. 2.



The heart of the child, showing the foramen ovale nearly closed by its valvular membrane after a respiration.

(Bock, 'Gerichtl. Sectionen des Menschlichen Körpers.')

Another valvular fold is formed on the right of the opening of the inferior cava, between it and the superior cava. This is called the Eustachian valve; it is represented in the engravings by the letter *d*. As a general rule, this valvular opening between the right and left sides of the heart exists during fœtal life, and becomes gradually closed after the establishment of respiration. I have, however, found it repeatedly open in children that had survived birth several hours; and, as it will be hereafter stated, the period of its closure is as variable as in the case of the ductus arteriosus. Hence, it is not capable of supplying with certainty evidence of live-birth, in those instances in which this evidence is most required. According to Billard, the foramen becomes closed between the second and third days: but there are numerous cases in which it is found not closed at much later periods after birth. Dr. Handyside states that it is more or less open in one case out of eight. In 1838 two subjects were examined at Guy's Hospital, one aged fifty, the other eleven years, and in both the foramen was found open. There is, however, another serious source of fallacy, which must be taken into consideration: the closure of the foramen ovale has been known to occur as an abnormal condition previously to birth and the performance of respiration. One case is mentioned by Capuron ('Méd. Lég. des Accouchemens,' p. 337), and another is reported in the 'Medical Gazette' (vol. 38, p. 1076). Other instances of this abnormal condition are adverted to by Dr. Chevers ('Med. Gaz.' vol. 38, p. 967); and it appears that in these the arterial duct remained open, in order to allow of the circulation of blood not only before but subsequently to respiration. The children rarely survive birth longer than from twenty to thirty hours. Dr. Chevers justly observes: — 'Cases of this description are of the highest importance in a medico-legal point of view, as they fully disprove the opinion maintained by many anatomists, that obliteration of the foramen ovale must be received as certain evidence that respiration has been established. It is assuredly impossible to deny that in the heart of a child which has died within the uterus, and has been expelled in a putrid condition, the foramen ovale may be found completely and permanently closed. In such cases as these it would, however, probably be always possible to determine, by an examination of the heart and its appendages, that the closure of the foramen had occurred at some period antecedent to birth.' Still, it would be unsafe in practice to rely upon the closure of this aperture as a proof of live-birth, in the absence of other good evidence: and in no instances can its patency be regarded as a proof that a child has come into the world dead. Dr. Kidd met with the case of a new-born child, in which a thick layer of lymph had been deposited across the aperture, so as nearly to block it up, and the ductus arteriosus was completely closed: the child could not have survived its birth more than a few hours ('Assoc. Jour.' Feb. 4, 1853, p. 104). This deposit of lymph is a condition not usually found. Dr. Peacock considers that the foramen is closed by the contraction of the muscular fibres of which the valve is constituted. In a medico-legal point of view, therefore, the patency or closure of this aperture possesses no longer any importance. ('Assoc. Jour.' Feb. 25, 1853, p. 177.)

As a general rule, these peculiar parts of the fœtal circulation are rarely obliterated by a normal process before the eighth or tenth day after birth. The obliteration, according to Bernt and Orfila, takes place in the following order:—1. The umbilical arteries; 2. The ductus venosus; 3. The ductus arteriosus; and 4. The foramen ovale. (Orfila, 'Méd. Lég.' 1848, vol. 2, p. 210.) The circumstances connected with the closure of these fœtal vessels have been statistically investigated by Dr. Elsässer. Among 70 still-born children they were found open in 69. Among 300 children who died soon after birth, 80 out of 108 prematurely born and living from one to eight days, presented all the passages open: 127 out of 192 infants born at the full time had all the passages open, but partly contracted. The ductus arteriosus was open in 55 cases, and completely closed in 10 cases; the ductus venosus was open in 81, and completely closed in 37 cases; while the foramen ovale was open in 47, and completely closed in 18 cases only. These facts, according to Dr. Elsässer, prove that the vessels peculiar to the fœtal circulation remain open as a rule for some time after birth, and that it is not possible to determine accurately, by days, the period of their closure. This physiologist remarked that the closure commenced and was often completed in the ductus venosus, before it manifested itself in the other vessels. The complete closure, in by far the greater number of cases, takes place within the first six weeks after birth, and the instances of obliteration before birth, or before the period mentioned after birth, must be regarded as rare exceptions. ('Med. Times and Gaz.' May 21, 1853, p. 530.)

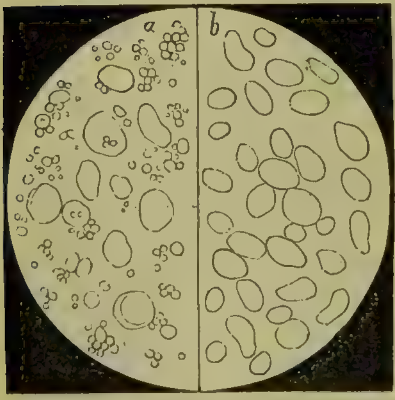
The result of this inquiry respecting Professor Bernt's *docimasia circulationis* is essentially negative: it either proves nothing, or it may lead the medical witness into a fatal error. It has been the more necessary to point out the serious fallacies to which it is liable, because hitherto medical jurists have been disposed to place great reliance upon it, in cases in which medical evidence from the state of the lungs was wanting. The necessity of these facts being known is shown by the case which occurred at Ayr (*ante*, p. 931), in which great reliance appears to have been placed upon the following statement by Dr. Beck:—'If, therefore, the ductus arteriosus be found cylindrical in its shape, and not contracted towards the aorta, and if it equal in size the trunk of the pulmonary artery, the inference would be that the child was not born alive. On the other hand, if the ductus arteriosus be contracted towards the aortal end, and if its size be much less than the trunk of the pulmonary artery, the inference would be that the child had been born alive.' (Beck's 'Med. Jur.'

5th ed., p. 251.) From a consideration of the preceding facts, it will be seen that such inferences might seriously mislead a Court of Law.

Evidence from the state of the alimentary canal.—Good evidence of live-birth may be sometimes derived from the discovery of certain liquids or solids in the stomach and intestines, such as blood, milk, or farinaceous or saccharine articles of food; for it is not at all probable that these substances should find their way into the stomach or intestines of a child which was really born dead.

1. *Starch.*—In the case of a new-born child, Dr. Geoghegan discovered, by the application of iodine-water, the presence of farinaceous food in the contents of the stomach; hence the question of live-birth was clearly settled in the affirmative. On another occasion Dr. Francis employed this method of testing with satisfactory results, in a case in which the investigation was beset with unusual difficulties. He was required by the coroner to examine the body of a new-born child, found under suspicious circumstances. The examination of the lungs left no doubt that respiration had taken place; and the fact that the child had been born alive was fully established by the discovery in the stomach of a small quantity of farinaceous food. On digesting in distilled water a fragment of the pulp found in this organ, and adding a drop of a solution of iodine, an intense indigo-blue colour appeared immediately. The application of this chemical test, therefore, removed any doubts which might have been entertained on the question of live-birth. ('Med. Gaz.' vol. 37, p. 460.) The quantity of starch present may, however, be too small to produce a solution with water which would be coloured by iodine in the manner described. A portion of the contents of the stomach should then be placed on a glass-slide, diluted with a little water if viscid, and examined under the microscope with a power of about 300 diameters. The granules (if present) may then be distinctly seen, having the shape peculiar to each variety of starch, and not unfrequently mixed with oil-globules and epithelial scales derived from the mucous membrane. By the addition of iodine-water their shape and size will be brought out by the intensely blue colour which they acquire. Blue fragments of an irregular shape indicate the presence of bread. The annexed engraving (fig. 1) represents two varieties of starch, either of which may be found in the stomachs of infants: in *a* the rounded granules of wheat-starch are represented, and in *b* the ovoid granules of arrowroot. The micrometrical measurements of these granules show, for those of wheat, which are irregularly spherical, diameters varying from 1-9000th to 1-1125th of an inch in size. Many have an average diameter of 1-3000th of an inch. The ovoid granule of arrowroot is 1-900th of an inch in length, and 1-1800th of an inch in width.

FIG. 1.



Granules of wheat-starch. Granules of arrowroot.

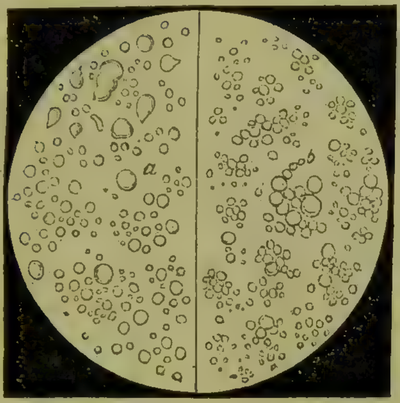
Magnified 319 diameters.

2. *Sugar.*—In one case which I was required to examine, the presence of sugar was readily detected in the contents of the stomach by the application of Trommer's test. In order to apply this test, a few drops of a weak solution of sulphate of copper should be added to a portion of the cold concentrated aqueous extract of the contents of the stomach. An excess of a solution of pure potash is then added, and the liquid boiled. If sugar be present, the suboxide of copper is immediately precipitated of a yellowish or reddish colour. With white sugar the same decomposition is effected, but more slowly. If starch be present, black oxide of copper may be thrown down, but there will be no

production of a red precipitate. The formation of the red oxide of copper under these circumstances, proves that some saccharine substance is present. In reference to the application of the sugar-test, however, it must be remarked that starch is easily convertible into sugar by a chemical action of saliva or mucus, so that the test may appear to indicate sugar in small quantity, when the result may be really due to the presence of some converted starch.

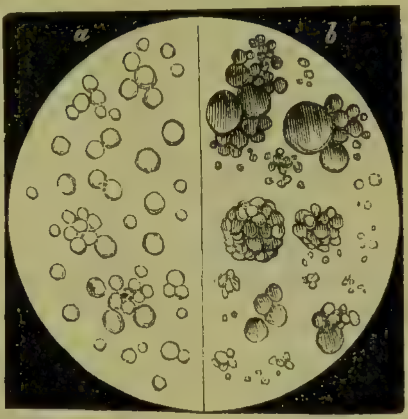
3. *Milk.*—This liquid may be found in the stomach of a new-born child; it may be identified microscopically in the fluids of the stomach by the numerous and well-defined oil-globules which it contains. It is not possible to distinguish human from cow's milk under these circumstances. In both, the globules which are spherical in all aspects, are remarkable for their transparency in the centre, and their dark margin. They vary considerably in size. I have found those of the cow to have by measurement the following diameters:—Maximum, 1-2200th of an inch; minimum, 1-18000th; and medium size, 1-4500th of an inch. They are distinguished from blood-corpuscles by their shape and lustre, and from starch-granules by the fact that they are not coloured or changed by iodine-water. *Colostrum* is the name applied to the milk first secreted after delivery; it contains, in addition to oil-globules, numerous spherical granular bodies (fig. 2, *b*). When milk is present, *lactine* or sugar of milk is generally found in the contents of the stomach by the appropriate sugar-test (*supra*). The casein, or solid principle of milk, precipitates oxide of copper from the sulphate; but on adding an excess of a solution of potash, the oxide is redissolved, forming a purple or violet-coloured solution. It is rapidly coagulated by the digestive principle (pepsine) contained in the gastric juice, so that the casein may be found in small soft masses adhering to the lining-membrane of the stomach. It should be observed that albumen forms a deep violet-coloured solution with sulphate of copper and potash, but the red suboxide of copper is not precipitated on boiling unless sugar is mixed with it.

FIG. 1.



Oil-globules of Human Milk. Oil-globules of Cow's Milk.
Magnified 319 diameters.

FIG. 2.



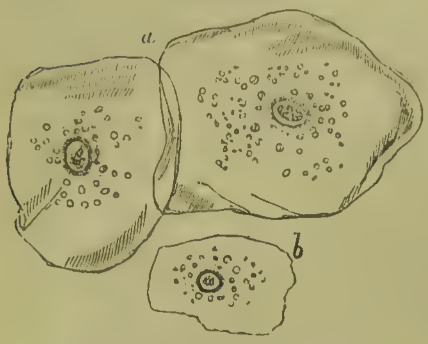
Oil-globules of Human Milk. Colostrum with granular bodies.
Magnified 450 diameters.

4. *Epithelial scales.*—The epithelial scales commonly found associated with articles of food in the stomach are of various shapes and sizes; they are flat, oval, or rounded, and sometimes polygonal. They are nucleated, and from their pavement-like appearance they are called 'tessellated.' In fig. 1, *b* (p. 938), an epithelial scale from the mucous membrane of the inside of the mouth, is represented magnified 570 diameters. In the long axis it was the 1-500th of an inch, and in the shortest 1-900th of an inch in diameter. The central nucleus was 1-4000th of an inch in diameter, and the small granules around it 1-9000th of an inch. These epithelial scales are very numerous, much intermixed, and

so transparent that they are often only distinctly seen at the edges, which occasionally are folded or slightly turned over.

Besides the substances mentioned, other solids and fluids, such as blood and meconium (the fæcal discharges of the fœtus) may be found in the stomach of a new-born child, and a question may arise whether their presence indicates that the child was fully born. It is not impossible that a child might be fed and exert a power of swallowing when its head protruded from the outlet, and its body was still in the body of the mother. Children have been known to exert a power of sucking or aspiration under these circumstances, and with this a power of swallowing might be exercised. In defending a prisoner on a charge of child-murder, counsel would scarcely resort to a defence of this kind. That the starch, sugar, or milk, &c. found in the stomach, should have been given to a child when its body was only half-born, is so improbable an hypothesis that the most inexperienced lawyer would hardly resort to it to account for the presence of food in this organ.

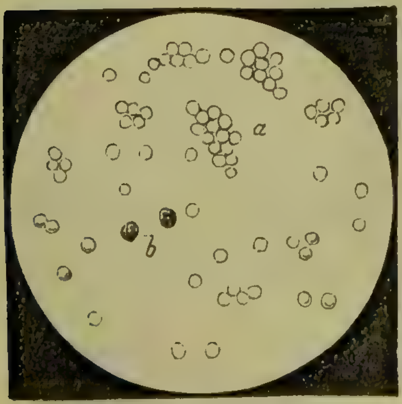
FIG. 1.



Tessellated epithelial scales.
a from Sharpey: *b* from observation.

When the substances found in the stomach are not in the form of food, but are fluids connected with the child or the mother, the case is different. These may penetrate into the lungs or stomach during birth, either by aspiration or the act of swallowing: they thus indicate that the child was living, but they do not necessarily show that its body was entirely in the world when they were swallowed.

5. *Blood.*—An instance is related by Dr. Döring in which a spoonful of coagulated *blood* was found in the stomach of a new-born child. The inner surfaces of the gullet and windpipe were also covered with blood. Dr. Döring inferred from these facts that the child had been born alive; for the blood, in his opinion, could have entered the stomach only by swallowing, *after* the birth of the child and while it was probably lying with its face in a pool of blood. Taken alone, however, such an inference would not be justifiable from the facts as stated. Blood might be accidentally drawn into the throat from the discharges of the mother during the passage of the child's head through the outlet, and yet the child may not have been born alive. The power of swallowing may be exerted by a child during birth either before or after the act of breathing. This power appears to be exerted even by the fœtus in utero.



Human blood-corpuscles with fibrine.

Blood may be recognized in the contents of the stomach not only by the colour which it imparts to the mucous liquids present, but by the aid of the microscope. This subject has been already fully considered in another part of this work (p. 453). The annexed illustration (fig. 2 *a.*) represents the blood-corpuscles as they may be seen under the microscope.

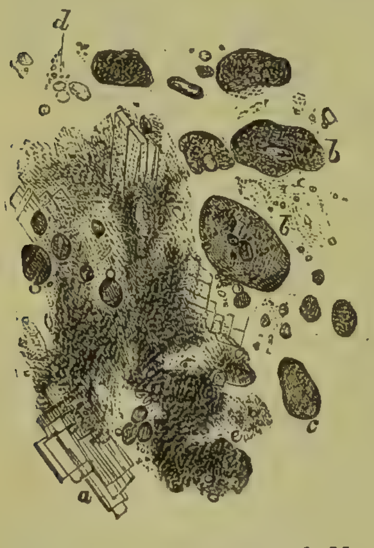
Dr. Robinson has made some researches on the contents of the fœtal stomach during uterine life. He finds that the substances which naturally exist in the stomach of a fœtus before birth are of an albuminous and mucous nature. His observations were made on the stomachs of two human fœtuses, and on those of the calf, lamb, and rabbit. The conclusions at which he arrived were:—1. That the stomach of the fœtus, during the latter period of its uterine existence, invariably contains a peculiar substance, differing from the uterine liquid (liquor amnii), and generally of a nutritious (?) nature. 2. That in physical and chemical properties, this substance varies in different animals, being in no two species precisely similar. 3. That in each fœtal animal the contents of the stomach vary at different periods; in the earlier stages of its development consisting chiefly of liquor amnii, to which the other peculiar matters are gradually added. 4. That the liquor amnii continues to be swallowed by the fœtus up to the time of birth, and consequently after the formation of those matters, and their appearance in the stomach. 5. That the mixture of this more solid and nutritious substance with the liquor amnii constitutes the material submitted to the process of chymification in the fœtal intestines. He considers the contents of the alimentary canal to be chiefly derived from the salivary secretion, and that gastric juice is not secreted until after respiration has been established. The medical jurist will perceive, therefore, that the discovery of farinaceous food, milk, or sugar in the stomach will furnish evidence of birth, since substances of this kind are not found naturally in this organ.

Dr. H. J. Gosse states that in the early stage of uterine life the alimentary canal contains merely a mucous liquid. At the third month there is a more copious secretion,—a clear non-albuminous acid liquid is found in the stomach, and a soft chymous liquid is present in the small intestines. Up to the fifth month the small intestines contain meconium of a greyish colour. After this period the meconium becomes gradually of a deeper colour, and it passes into the large intestine. When the child has attained uterine maturity, the meconium in the jejunum is whitish; in the ileum, yellow; in the cæcum, greenish-yellow; in the ascending colon, green with less yellow; and in the rectum, green-black, like poppy-juice (hence the name, from μεκων, 'a poppy'). It is a mixture of the constituent parts of the bile-coloured granules, of epithelium from the mucous membrane lining the intestines, and of mucous matters probably derived from the destruction of the epithelial cells. Meconium is generally discharged from the bowels of a child within forty-eight hours after birth, or at the latest on the third day. It then appears of the consistency of honey, of a very dark-green (almost black) colour, with very little yellow colouring-matter in it. It has no disagreeable odour. Its specific gravity is 1·148. ('Des Taches au Point de vue Medico-légale,' 1863, p. 75.)

6. *Meconium.*—This name is applied to the excrementitious matter produced and retained in the intestines during fœtal life. It may be found in the stomach of a new-born child, and a question will thence arise whether its presence there should be taken as a proof of entire live-birth. It may be discharged from the child during delivery, in cases in which there is a difficult or protracted labour. In the act of breathing it may enter the throat with other discharges, and thus be found in the stomach. That a breathing child can thus swallow meconium cannot be disputed, but, assuming that in the body of a child which has not lived to breathe this substance is found in the air-passages and stomach, how is the conclusion affected? In the following case Dr. Fleischer was required to examine the body of a new-born child which was said to have been born dead. He found meconium in the large intestines (the colon and rectum), and a greenish-yellow-coloured liquid in the cavity of the stomach, in the larynx, windpipe, and gullet. In the air-passages it was in well-marked quantity. The lungs contained no air, but possessed all the usual fœtal characters. When cut into pieces and placed on water, all the pieces sank. It appeared that a woman was present at the birth, who observed that the child did not breathe, but was born dead. It was not bathed

or washed, and no air was blown into its lungs. From the general appearance and properties of the liquid found in the stomach and air-passages, Dr. Fleischer had no doubt that it was meconium from the intestines of the child. It could not have been swallowed after the child was born, but must have been accidentally drawn into its throat by efforts to breathe during birth. Some of the meconium had probably been discharged from the bowels of the child during labour, and as the mouth passed over this liquid a portion was drawn into the throat by aspiration. When once there, the instinctive act of swallowing would immediately convey a portion of it into the stomach. As the facts connected with the birth were well known, this appears to be the only reasonable explanation. (See report of the case in Casper's 'Vierteljahrschrift,' 1863, vol. 1, p. 97; also for another case, 'Med. Times and Gazette,' August 3, 1861, p. 116.)

The presence of fluids therefore—such as *blood*, *meconium*, or the watery discharges attending delivery—in the stomach and air-passages of a new-born child, does not prove live-birth, but merely indicates the existence of some living actions in the child at or about the time of its birth. In a case which occurred to Dr. Ramsbotham, a woman was suddenly delivered of a child while sitting over a slop-pail of dirty water. On examining the body, it was obvious that it had not breathed. There was no air in the lungs, but a quantity of dirty water like that in the pail was found in the stomach. This could have entered the organ only by the act of swallowing, and, in Dr. Ramsbotham's opinion, the child had swallowed the liquid under some fœtal attempt to breathe. The coroner who held the inquest directed the jury that the child was born dead: but most physiologists will consider that the power of swallowing cannot be exerted by a dead child; and as its body must have been entirely delivered in order to have fallen into the liquid, there was proof that it had been born living, and that in this instance it had died after it was entirely born, by the prevention of the act of breathing. (See 'Live Birth,' p. 798.)



Microscopical appearances of Meconium:—*a* crystals of cholesterine; *b* epithelial scales; *c* masses of green colouring-matter of bile (biliverdin); *d e* granules.
Magnified 400 diameters.

The *meconium* may be generally recognized by its dirty-green colour and general appearance, as well as by the absence of any offensive odour, which it does not acquire until after the third or fourth day, when it becomes mixed with feculent matter. Its microscopical characters are represented in the annexed engraving. In the air-passages it is sometimes associated with vernix caseosa, and hairs derived from the skin. ('Med. Times and Gazette,' June 1, 1861, p. 591, and Aug. 3, 1861, p. 117; see also 'Ann. d'Hyg.' 1855, vol. 2, p. 445.)

But little need be said on its chemical properties; still, as the detection of stains of meconium on clothing may occasionally form a part of the medical evidence, a few observations are here required. The stains which it produces are of a brownish-green colour, very difficult to remove by washing. They stiffen the stuff, and are usually slightly raised above the surface, without always penetrating it. Meconium forms with water a greenish-coloured liquid, having an acid reaction: a boiling heat does not affect the solution. Nitric acid, and sulphuric acid and sugar yield with it the green and red-coloured compounds which they produce with bile. Cholesterine may be separated from it by hot ether.

It may be remarked, in reference to stains produced by the fæces of a child which has survived birth, that until the fifth or sixth day they retain a dark-green or greenish-yellow colour. On the seventh day after birth, they generally acquire a bright-yellow colour, like that of the yolk of an egg; and this colour, if the child is in health, they will retain during all the time that it is suckled.

The presence of stains of meconium on the clothing of a child has been considered, in the absence of any evidence from the lungs, to furnish sufficient proof that a child has been *born alive.* In March 1850 the body of a child, completely dried or mummified, was found concealed in a hollow space in the chimney of a house. From the dry state of the body, it had apparently been there for a considerable time. Dr. Bergeret was required to examine the body. He found it to have the characters of a mature child of the female sex. It was wrapped in linen, which was marked by two kinds of stains, some of a deep-green almost black (meconium), and others of a reddish-brown colour (blood). The internal organs had been completely destroyed, chiefly by larvæ of insects, of which many of the dried chrysalis-cases were found. The skin was dried to a parchment condition. Was this child born alive? As the lungs were destroyed, Dr. Bergeret directed his attention to the meconium-stains on the linen; and he concluded from these that, had the child died before or during labour, the greater part of the meconium would have been discharged before birth. Assuming that a quantity of it still remained in the bowels, this could not have been discharged from them, as a result of vital contractility after death. Further, the portion of linen around the nates of the child was not stained, hence there had been no discharge *post-mortem*, after the dead body had been placed in the chimney—leading therefore to the conclusion that the linen had been stained by the natural discharge from a child born living, and previous to the disposal of its body. Dr. Bergeret also inferred, from the large quantity of meconium, that it had been discharged during a state of severe suffering resulting from a violent death. ('Ann. d'Hyg.' 1855, vol. 2, p. 442.) He gave his opinion—1. That this mummy-child was mature; 2. That it was born alive, and that it died from violence soon after its birth; and 3. That its death probably took place in the summer of 1848, *i.e.* about two years before the discovery of the body. The latter conclusion was based on entomology, *i.e.* on the condition of the chrysalis-cases and the larvæ of the *musca carnaria* found in the cavities of the body. The facts were such that, in Dr. Bergeret's opinion, a shorter period than two years would not account for the state in which the insects were discovered. A woman who had been, it was supposed, delivered of a child in November 1848, was tried upon this evidence, before the Jura Court of Assizes, on a charge of child-murder. The jury acquitted her. In England such a case would not have gone beyond a coroner's inquest. There was no evidence of live-birth, for the stains of meconium on the linen might be accounted for irrespective of this theory. There was no evidence of murder, for all the facts admitted of an explanation on the assumption that the child had been either still-born, or, if born living, that it had died from natural causes soon after its birth, and that its body had been concealed in the spot where it was found.

Evidence from the mode of birth.—It has been suggested that when a child is born by the feet, and there are full marks of respiration in the lungs, the mode of birth will at once establish that the body must have been entirely in the world in order that the breathing should have taken place. Dr. W. B. Herapath met with an instance of this kind in September 1858, and communicated the particulars to me. It is assumed that the head under these circumstances is born instantaneously, and that the child cannot breathe until the head is released from the outlet. Before such a conclusion can be drawn, there should be clear evidence that the child was actually born by the feet. Dr. Herapath has published a report of the case on which his opinion was requested, as well as the grounds on which he would rely to establish the fact that a child had been born by the feet. (For this I must refer the reader to the 'British Medical Journal,' May 15, 1859.)

The slightest consideration will show that the various signs of live-birth above described are weak, and of purely accidental occurrence. If a child is destroyed either during birth, or within a few minutes afterwards, there will be no medical evidence to indicate the period at which its destruction took place; the external and internal appearances presented by the body would be the same in the two cases. It is most probable that in the greater number of instances of child-murder, a child is actually destroyed either during birth, or immediately afterwards; and, therefore, the characters above described can rarely be available in practice. If any exception be made, it is with respect to the nature, situation, and extent of marks of violence; but the presence of these depends on mere accident. Hence, then, we come to the conclusion, that although medical evidence can generally show, from the state of the lungs, that a child has really lived, it can rarely be in a condition to prove, in a case of infanticide, that its life certainly continued after its birth. We could only venture upon this inference when the signs of breathing were full and complete, or when some article of food was found in the stomach. Why the destruction of a child should be treated in the one case as a venial offence, and in the other as a capital crime, is one of those anomalies in our criminal jurisprudence for which it is impossible to account. The inference which we may draw from these observations is, that if positive proof of *entire live-birth* be in all cases rigorously demanded of medical witnesses on trials for child-murder, it is scarcely possible, when the prisoner is ably defended, that any conviction for the crime should take place. The only exception would be where a confession was made by the accused, or a murder was actually perpetrated before eye-witnesses. The numerous acquittals that take place on trials for this crime, in face of the strongest medical evidence of murderous violence, bear out the correctness of this opinion. A child is proved to have lived and breathed, but the medical evidence fails to show that the living and breathing took place or continued after its *entire* delivery. [For some judicious remarks on this defective state of the law, see 'Prov. Journ.' April 2, 1851, p. 182.]

Conclusions.—The general conclusions which may be drawn from the facts contained in this chapter, on the question whether a child has or has not been *born alive*, are as follows:—

1. That if the lungs be fully and perfectly distended with air by the act of breathing, this affords a strong presumption that the child has been *born alive*, since breathing during birth is in general only partial and imperfect.

2. That the presence of marks of severe violence on various parts of the body, if possessing vital characters, renders it probable that the child was entirely born alive when the violence was inflicted.

3. That certain changes in the umbilical vessels, and the separation by a vital process and cicatrization of the umbilical cord, as well as a general peeling or scaling-off of the cuticle, indicate live-birth.

4. That the absence of meconium from the intestines and of urine from the bladder, are not proofs that a child has been entirely born alive, since these liquids may be discharged during the act of birth.

5. That the open or contracted state of the foramen ovale or ductus arteriosus furnishes no evidence of a child having been born alive. These parts may become closed and contracted *before birth*, and therefore be found closed

in a child born dead; or they may remain open after birth in a child born living, even subsequently to the establishment of respiration.

6. That the presence of farinaceous or other food in the stomach proves that a child has been entirely born alive.

7. That the presence of blood, meconium, vernix caseosa, or the discharges in the stomach and air-passages, does not prove that a child was born alive.

8. That, irrespective of the above conclusions, there is no certain medical sign which indicates that a child, that has died at or about the time of birth, has been *entirely* born alive.

CHAPTER 73.

RULES FOR DETERMINING THE PERIOD OF SURVIVORSHIP IN CHILDREN THAT HAVE BEEN BORN ALIVE—APPEARANCES INDICATIVE OF A CHILD HAVING LIVED TWENTY-FOUR HOURS—FROM TWO TO THREE DAYS—FROM THREE TO FOUR DAYS—FROM FOUR TO SIX DAYS—FROM SIX TO TWELVE DAYS—UNCERTAINTY OF MEDICAL EVIDENCE ON THE PERIOD WHICH HAS ELAPSED SINCE THE DEATH OF A CHILD—PROCESS OF PUTREFACTION IN THE BODIES OF NEW-BORN CHILDREN.

If we suppose it has been clearly established that a child not only lived but was actually *born* alive, it may be a question whether it lived for a certain number of hours or days after it was born. The answer to this question may be necessary in order to connect the deceased child with the supposed mother. It has been remarked that scarcely any appreciable changes take place in the body of a living child until after the lapse of twenty-four hours; and these changes may be considerably affected by its degree of maturity, healthiness, and vigour. The following may be taken as a summary of the appearances observable in the body of a child that has survived its birth for the undermentioned periods:—

1. *After twenty-four hours.*—The skin is firm and less red than soon after birth. The umbilical cord is somewhat shrivelled, although it remains soft and bluish-coloured, from the point where it is secured by a ligature to its insertion in the skin of the abdomen. The meconium may be discharged; but a green-coloured mucus is found on the surface of the large intestines. The lungs may be more or less distended with air, although in a case of survivorship for a period longer than this, no trace of air was found in them. With regard to the state of the lungs, it should be remembered that when these organs are fully and perfectly distended, the inference is that the child has probably survived many hours; but the converse of this proposition is not always true. Several cases already reported show that when the lungs contain a small quantity of air, it does not follow that the child must have died immediately after it was born.

2. *From the second to the third day.*—The skin has a yellowish tinge, the cuticle sometimes appears cracked, a change which precedes its separation in scales. (Devergie, vol. 1, p. 519.) The umbilical cord is brown and dry between the ligature and the abdomen.

3. *From the third to the fourth day.*—The skin is more yellow, and there is an evident separation of the cuticle from the skin of the chest and abdomen. The umbilical cord is of a brownish-red colour, flattened, semitransparent, and twisted. The skin in contact with the dried portion presents a ring of vascularity or redness, gradually shaded off towards the abdomen. Dr. Geoghegan met with this appearance in two cases of still-born children, and I have also seen it in four cases in which the children were born dead. ('Guy's Hospital Reports,' April 1842.) The colon is free from any traces of green mucosity.

4. *From the fourth to the sixth day.*—The cuticle in various parts of the body is found separating in the form of minute scales or of a fine powder. The umbilical cord separates from the abdomen usually about the *fifth day*, but sometimes not until the eighth or the tenth day. The membranous coverings become first detached, then the arteries, and afterwards the veins. If the umbilical aperture is cicatrized and *healed*, it is probable that the child has lived from three weeks to a month after birth. The ductus arteriosus may be found contracted both in length and diameter; the foramen ovale may be also partly closed.

5. *From the sixth to the twelfth day.*—The cuticle will be found separating from the skin of the limbs. If the umbilical cord was small, cicatrization will have taken place before the tenth day after birth; if large, a sero-purulent discharge will sometimes continue to escape from it for twenty-five or thirty days. The ductus arteriosus is said to become entirely closed during this period; but this statement is open to exceptions, which have been elsewhere pointed out (*ante*, p. 931). It need hardly be observed that the body rapidly increases in size and weight when the child has enjoyed active existence.

On the whole, it will be seen that the signs of survivorship for short periods after birth are not very distinct. There is commonly no difficulty in determining the fact after the second day. The changes stated to take place in the umbilical cord during the first twenty-fours may be observed in the *dead* as well as in the living child, and the other changes occur with much uncertainty as to the period. These are, however, I believe the principal facts upon which a medical opinion on such a subject can be based; and it is in some respects fortunate that great precision in assigning the time of survivorship is not demanded of medical witnesses. (See on this subject a paper by Dr. Elsässer in Henke's 'Zeitschrift der S. A.' 1842, vol. 2, p. 220; 'Ueber die Neugeborenheit.')

Putrefaction in a new-born child.—A practitioner may be further required to state *how long a period has elapsed since the death of a child.* The answer to the previous question was derived from the changes which take place in the body of a child during *life*, while, in relation to the present enquiry, we must look to those which occur in the body after *death*—in other words, to the different stages of putrefaction. Before this process sets in, however, there are certain changes connected with the cooling of the body and the production of rigidity in the muscles which have been elsewhere described (pp. 8 and 11). From its small mass the body of a new-born child will cool much more rapidly than that of an adult when exposed under similar circumstances. Rigidity may also take place quickly, and quickly disappear. When the body presents no sign of putrefaction externally—no greenness of the skin of the abdomen—these post-mortem changes are the only data on which a medical opinion can be based. From the observations of Orfila, it would appear that the body of an infant putrefies more rapidly than that of an adult. ('Traité des Exhumations.') In forming a judgment on this point, due allowance must be made for the influence of temperature, humidity, and the free access of air (see p. 56, *ante*). If the body has been sunk in water, putrefaction takes place more slowly than usual, and the process is slower in running than in stagnant water. When the body is floating on the surface of water, so as to be at the same time exposed to air, then putrefaction takes place very rapidly: and this also happens when the body, after removal from water, has been exposed to the air for some time. Putrefaction is retarded when the deceased child has been buried in the ground in a box or coffin, unless the process had commenced prior to interment. When the body has been cut up and mangled before being thus disposed of, putrefaction takes place with much greater rapidity. (The *Queen* v. *Railton*, Stafford Winter Assizes, 1844.)

Conclusions.—The general conclusions respecting survivorship are:—

1. That the period for which a new-born child has survived birth cannot be determined by any certain sign for the first twenty-four hours.

2. That after this period an inference may be drawn from certain changes which take place progressively in the skin and umbilical cord externally, and in the viscera on inspection; that these changes allow only of an approximate opinion within the first five or six days.

3. That the contraction of the foramen ovale and ductus arteriosus takes place from natural changes at such uncertain intervals as to render it difficult to assign a date of survivorship from the state of these parts.

4. That the period which has elapsed since the child died after it was born, can be determined only by observing the degree of putrefaction in the body compared with temperature, locality, and other conditions to which it has been exposed. (See PUTREFACTION, p. 53.)

CHAPTER 74.

CAUSES OF DEATH IN NEW-BORN CHILDREN—PROPORTION OF CHILDREN BORN DEAD—NATURAL CAUSES OF DEATH—A PROTRACTED DELIVERY—DEBILITY—BLEEDING FROM LACERATION OF THE NAVEL-STRING—COMPRESSION OF THE NAVEL-STRING—MALFORMATION—DESTRUCTION OF MONSTROUS BIRTHS—DEATH FROM CONGENITAL DISEASE.

Causes of death in new-born children.—The next important question in a case of infanticide, and that upon which a charge of murder essentially rests, is,—what was the cause of death? 1. It is admitted that a child may die during birth or afterwards. 2. In either of these cases it may die from *natural* or *violent causes.* The violent causes may have originated in *accident* or in *criminal design.* The last condition only involves the corpus delicti of child-murder. If death has clearly proceeded from natural causes, it is of no importance to settle whether the cause operated during or after birth—all charge of criminality is thenceforth at an end.

Proportion of children born dead.—It is well-known that of children born under ordinary circumstances, a great number die from natural causes either during birth or soon afterwards; and in every case of child-murder, death will be presumed to have arisen from some cause of this kind, until the contrary appears from the evidence. This throws the onus of proof entirely on the prosecution. Many children die before performing the act of respiration; and thus a large number come into the world dead or still-born. The proportion of *still-born* among legitimate children, as it is derived from statistical tables extending over a series of years, and embracing not fewer than eight millions of births, varies from one in eighteen to one in twenty of all births. ('Brit. and For. Med. Rev.' No. 7, p. 235.) The late Dr. Lever found, that among three thousand births, one child in eighteen was born dead. In immature and illegitimate children, the proportionate mortality is much greater,—probably about one in eight or ten. In Göttingen the deaths were found to amount to one in seven, and in Berlin to one in ten. ('Edin. Med. and Surg. Jour.' vol. 36, p. 172.) Males are more frequently born dead than females, in the ratio of 140 : 100,—while the males to females born, has only a ratio of 106 : 100. (Dr. Simpson, 'Edin. Med. and Sur. Jour.' Oct. 1844, p. 395.) The preponderance of still-births among males is ascribed to the large size of the head, and the injury thus likely to be inflicted on the brain during delivery. Still-births are much more frequent in first than in after-pregnancies. These facts should be borne in mind, when we are estimating the probability of the cause of death being natural. Thus, children are much more frequently born dead among primiparous than among non-primiparous females. According to Dr. Lawrence's observations, the proportion of deaths is 1 to 11 of the primiparous and 1 to 31·2 among the non-primiparous. ('Edin. Med. Jour.' March 1863, p. 815.) In most cases of child-murder the woman is primiparous.

Should breathing be established by the protrusion of the child's head from the outlet, or during the birth of the body, the chances of death from natural causes are considerably diminished. Nevertheless, as Dr. Hunter long ago suggested, a child may breathe and die. Thus, according to this author,—'If the child makes but one gasp and instantly dies, the lungs will swim in water as readily as if it had breathed longer and had then been strangled.' In general, it would require more than one gasp to cause the lungs to swim readily in water; but waiving this point, the real question is,—If the child breathed after birth, what could have caused its death? The number of gasps which a child may make, or which may be required for the lungs to swim in water, is of no moment: the point to be considered is, whether its death was due to causes of an accidental or criminal nature. So again observes Dr. Hunter: 'We frequently see children born, who, from circumstances in their constitution or in the nature of the labour, are but barely alive, and after breathing a minute or two, or an hour or two, die in spite of all our attention. And why may not this misfortune happen to a woman who is brought to bed by herself?' (Op. cit.) The substance of this remark is, that many children may die naturally after having been born alive; and in Dr. Hunter's time, these cases were not perhaps sufficiently attended to. In the present day, however, the case is different: a charge of child-murder is seldom raised, except in those instances where there are the most obvious marks of severe and mortal injuries on the body of a child; and unless it be intended to defend and justify the practice of infanticide, it must be admitted that the discovery of violence of this kind on the body of a new-born infant renders a full enquiry into the circumstances necessary. Among the *natural causes* of the death of a child may be enumerated the following:—

1. *A protracted delivery.*—The death of a child may proceed, in this case, from injury suffered by the head during the violent contractions of the uterus, or from an interruption to the circulation in the umbilical cord before respiration is established. A child, especially if feeble and delicate, may die from exhaustion under these circumstances. This cause of death may be suspected when a sero-sanguinolent tumour (called *cephalœmatoma*, or *caput succedaneum*) is found on the head of a child, and the head itself is deformed or elongated:—internally, by the congested state of the vessels of the brain. The existence of deformity in the pelvis of the woman might corroborate this view; but in primiparous women (among whom charges of child-murder chiefly lie) with well-formed pelves, delivery is frequently protracted. It is presumed that there are no marks of violence on the body of the child, excepting those which may have reasonably arisen from accident in attempts at self-delivery.

2. *Debility.*—A child may be born either prematurely or at the full period, and not survive its birth, owing to a natural feebleness of system. This is observed among immature children; and it is a condition especially dwelt on by Dr. Hunter. Such children may continue in existence for several hours, breathing feebly, and may then die from mere weakness. These cases may be recognized by the immature condition of the body and the appearance of a general want of development.

3. *Bleeding from laceration of the navel-string.*—A child may die from loss of blood, owing to a premature separation of the placenta or an accidental rup-

ture of the umbilical cord. In the latter case it is said the loss of blood is not likely to prove fatal if breathing has been established; but an instance is reported in which a child died from bleeding even under these circumstances. (Henke's 'Zeitschrift,' 1839, Erg. H. p. 200; also, 1840, vol. 1, p. 347, and vol. 2, p. 105; 'Ann. d'Hyg.' 1831, vol. 2, p. 128.) Bleeding from the cord has in some cases taken place at various periods after birth, and has led to the death of the child. ('Edin. Month. Jour.' July 1847, p. 70.) Death from bleeding may be commonly recognized by the blanched appearance of the body and a want of blood in the internal organs; but there are several cases on record in which the cord was ruptured close to the abdomen without causing the death of the child. It was formerly a debated question whether, in the event of the umbilical cord being left untied after cutting or laceration, such a degree of hæmorrhage could in any instance occur as would prove fatal to a child. The case just now referred to renders it unnecessary to discuss this question. Bleeding is more likely to prove fatal when the cord is divided by a sharp instrument than when it is lacerated; and its dangerous effects on a child are likely to be great in proportion as the division is made near to the navel. It has been improperly described as a case of infanticide by *omission*, when a self-delivered woman neglects to apply a ligature to the cord under these circumstances; because, it is said, she ought to know the necessity for this in order to prevent the child dying from hæmorrhage. Such a view assumes not only malice against the accused, but that in the midst of her distress and pain she must necessarily possess the knowledge and bodily capacity of an accoucheur,—a doctrine wholly repugnant to the common feelings of humanity. This question was, however, actually raised in the case of the *Queen* v. *Dash*, August 1842. There was no doubt in this instance that the child had breathed, and that its death had been caused by bleeding from the lacerated umbilical cord. The medical witness properly admitted that the cord might have been torn through by the mere weight of the child during labour; and the jury acquitted the prisoner, on the ground that she might have been ignorant of the necessity, or not have had the power to tie the cord. The cord, especially when short, may become accidentally ruptured during delivery. A case of this kind occurred to Mr. Mackie. ('Med. Times,' July 24, 1847, p. 433.) The child was born alive after a strong pain; and on examination it was found that the cord was torn through at about an inch from the abdomen.

Bleeding from the vessels of the navel-string may prove fatal several days after birth, even when a child has been properly attended to, and the navel-string has separated by the natural process. Mr. Willing has reported a case of this kind, in which, in spite of every application, the child died from loss of blood six days after the cord had separated. ('Med. Times and Gaz.' March 25, 1854, p. 287.) The impossibility of arresting the bleeding in this case appeared to depend upon a great deficiency of fibrin in the blood, and a consequent want of tendency to coagulation.

4. *Compression of the navel-string.*—When a child is born by the feet or buttocks, the cord may be so compressed under strong uterine contraction hat the circulation between the mother and child will be arrested, and the atter will die. The same fatal compression may follow when, during deivery, the cord becomes twisted round the neck. A child has been known o die under these circumstances before parturition, the cord having become wisted round its neck in the uterus. ('Med. Gaz.' Oct. 1840, p. 122.) Other ases from this cause, during delivery, will be found in the same journal. Vol. 19, pp. 232, 233.) On these occasions the child is sometimes described o have died from strangulation, but it is evident that before the establishment of respiration such a form of expression is improper. There are few or no appearances indicative of the cause of death. There may be lividity about

the head and face, with a mark or furrow on the neck, and congestion of the brain internally: it is, however, proper to state that the brain of a child is always more congested than that of an adult.

5. *Malformation. Monstrosity.*—There may be a deficiency of some vital organ which would at once account for a child dying either during delivery or soon after its birth. Two cases are reported, in one of which the child died from an absolute deficiency of the gullet,—the pharynx terminating in a cul-de-sac: in the other, the duodenum was obliterated for more than an inch, and this had occasioned the child's death. ('Med. Gaz.' vol. 26, p. 542.) In a third, recorded by Mr. Fairbairn, a child was suffocated by retraction of the base of the tongue, owing to defect of the frænum. ('North Jour. Med.' March 1849, p. 278.) The non-establishment of respiration sometimes arises from the mouth and fauces of the child being filled with mucus. An enlargement of the thyroid gland has occasionally led to the death of a new-born child by suffocation. ('Edin. Month. Jour.' July 1847, p. 64.) The epiglottis is sometimes fixed over the glottis so as to prevent the entrance of air. In a case which occurred to Dr. Hicks, a child was saved by the introduction of a finger: the air suddenly rushed in, and the child was enabled to breathe. But a child may be born in this state when no person is at hand to assist the woman: in this case it will die; and the lungs being found in the fœtal or unexpanded condition, it will be pronounced still-born. Obstruction of the air-passages is a frequent cause of death among still-born children (p. 951).

The varieties of *malformation* are very numerous, but there can be no difficulty in determining whether they are such as to account for death. Persons are not allowed to destroy monstrous births; and the presence of all marks of violence in such cases should be regarded with suspicion. It is the more necessary to make this statement, as there is an idea among the vulgar that it is not illegal to destroy a monstrous birth. Mr. Pooley, of Cirencester, communicated to me a case which occurred some years since in his practice. A lady was delivered of a most hideous dicephalous (two-headed) monster. In his absence, and at the earnest solicitations of the friends, the nurse destroyed it. The question was—was this woman guilty of child-murder? The only case in reference to this point which is recorded by medico-legal writers, is that of two women who were tried at the York Assizes in 1812, for drowning a child which was born with some malformation of the head, in consequence of which it was likely that it could not survive many hours. It did not appear that there had been any concealment on the part of the prisoners, who were not aware of the illegality of the act. (Paris and Fonblanque, 'Med. Jur.' vol. 1, p. 228.) The absence of malicious intention would probably lead to an acquittal on a charge of murder, but such an act would doubtless amount to manslaughter: the degree of monstrosity or the viability of the offspring cannot be received as extenuating circumstances. As to the first, if a liberty of judging what was monstrous and what not, were conceded to any ignorant nurse, children simply deformed might be put to death on this pretence: as to the second, it is held in law that whoever accelerates death causes it,—hence the fact that the offspring is not likely to live more than a few hours does not justify the act of one who prematurely destroys it.

6. *Atelectasis.*—This, as it has been elsewhere explained (p. 904), implies simply an unexpanded state of the lungs. In some cases it is completed, in others partial. (See illustration, p. 904.) It can scarcely be regarded as a diseased condition, as the body of the child may be otherwise healthy: the lungs themselves are in a normal state, and they can be easily expanded by the artificial introduction of air.

7. *Congenital disease.*—It has been elsewhere stated, that a child may be

born labouring under such a degree of congenital disease as to render it incapable of living. The discovery of any of the fœtal organs merely in a morbid condition amounts to nothing unless the disease has advanced to a degree which would be sufficient to account for death. There are, doubtless, many obscure affections, particularly of the brain, which are liable to destroy the life of a child without leaving any well-marked changes in the dead body. According to Dr. Burgess, apoplexy and asphyxia are common causes of death among new-born children. ('Med. Gaz.' vol. 26, p. 492; Henke's 'Zeitschrift der S. A.' 1843, p. 67.) Probably diseases of the lungs are of the greatest importance in a medico-legal point of view; because, by directly affecting the organs of respiration, they render it impossible for a child to live, or to survive its birth for a long period. These diseases in the fœtal state are principally congestion, hepatization, tubercle, scirrhus, and œdema,—the existence of any of which it is not difficult to discover. They render the structure of the lungs heavier than water, and thus prevent the organs from acquiring that buoyancy which in their healthier state they are known to possess. It is not common to find the lungs diseased throughout—a portion may be sufficiently healthy to allow of a partial performance of respiration.

Conclusions.—The following conclusions may be drawn from the preceding remarks:—

1. That a large number of illegitimate children, especially when immature, are born dead from *natural* causes.

2. That a child may die from exhaustion as the result of a protracted labour.

3. That if a child be prematurely born, or if it be small and weak even at the natural period, it may die from mere debility or want of power in the constitution either to commence or to continue the act of respiration.

4. A child may die from loss of blood, owing to accidental rupture of the cord during delivery: it may even die from this cause after it has breathed.

5. That fatal bleeding is more likely to occur when the cord has been cut close to the abdomen than when it has been lacerated or cut at a distance from the navel.

6. That the division of the cord, whether by rupture or incision, without ligature, is by no means necessarily fatal to a healthy mature child.

7. That a child may die from accidental compression of the cord during delivery—the circulation between the mother and child being thereby arrested before respiration has commenced.

8. That death may speedily follow birth from some malformation or defect, or defective condition of important organs.

9. That a child may die from congenital disease affecting the organs of respiration or the air-passages.

CHAPTER 75.

VIOLENT CAUSES OF DEATH—FORMS OF VIOLENT DEATH UNATTENDED BY MARKS OF EXTERNAL VIOLENCE—SUFFOCATION—DROWNING—IN THE SOIL OF PRIVIES—POWER OF LOCOMOTION AND EXERTION IN FEMALES AFTER DELIVERY—DEATH OF THE CHILD FROM COLD AND EXPOSURE—STARVATION—IMMATURITY IN CASES OF ABORTION—WOUNDS IN NEW-BORN CHILDREN—FRACTURES OF THE SKULL, SPONTANEOUS AND CRIMINAL—DEATH OF THE CHILD FROM DELIVERY IN THE ERECT POSTURE—ACCIDENTAL INJURIES IN UTERO—DEFICIENT OSSIFICATION—TWISTING OF THE NECK—VIOLENCE IN SELF-DELIVERY.

Violent causes of death.—In this chapter we have to consider those modes of death which are totally independent of the existence of congenital disease or other natural causes. It is proper for a medical jurist to remember that there are certain forms of child-murder which are not necessarily attended with any appearances indicative of violence; these are suffocation, drowning, exposure to cold, and starvation. (See a paper on the violent causes of death in new-born children, by Casper, in his 'Vierteljahrschrift' for 1863, vol. 2, p. 1.)

1. *Suffocation.*—This is a common cause of death in new-born children. A wet cloth may be placed over the child's mouth, or thrust into this cavity, either during birth or afterwards, and before or after the performance of respiration. To the latter case only could the term suffocation be strictly applied. A child may be thus destroyed by being allowed to remain closely compressed under the bed-clothes after delivery, or by its head being thrust into straw, feathers, ashes, and similar substances. The appearances in the body are seldom sufficient to excite a suspicion of the cause of death, unless undue violence has been employed. There is commonly merely lividity about the head and face, with slight congestion of the lungs. A careful examination of the mouth and throat should be made, as foreign substances are sometimes found in this situation, affording circumstantial evidence of the mode in which the suffocation has taken place. Thus wood, straw, feathers, dust, tow, or a hard plug of linen may be, and in some cases have been, found blocking up the mouth and fauces, drawn into these parts by aspiration when the mouth of a child has been covered with such substances. (See SMOTHERING, p. 704.) If a child has lived sufficiently long to be fed, it may be accidentally suffocated by the entrance of portions of food into the windpipe and air-passages. The following case in reference to a child which survived its birth thirty days, which occurred to Mr. Ross of Guildford, will throw a light upon this accidental cause of death:—An infant, thirty days old, was found dead in bed. the mother, a married woman, the wife of a labourer, stated that the child was healthy, and was put to bed after having sucked well at 7 P.M. the previous evening; also once in the night about 2 A.M. On awaking at 4.30 A.M. she found the child dead. It was lying on her right side—the farthest side from the father, and on its own left side looking towards its mother. When seen by Mr. Ross it was on its back; the hands were clenched, the lips blue and pouting, and the tongue thrust out a little way between them. There were no marks of violence or of flattening of the features. The lungs and right cavities of the heart were distended with blood. The stomach contained a quantity of curdled milk. On opening the larynx a small quantity of the curd of milk was found resting on the vocal chords of the larynx and lining the upper two or three rings of the windpipe, thus completely blocking

up the tube, which in calibre was not larger than a goosequill. It appeared that on the previous day the child had frequently thrown up its milk; it had probably vomited it in the night while its face was turned towards the pillow, and had by aspiration drawn a portion of the curd of milk into the air-passages, and thus caused death by suffocation. An infant of this age would not have the power to relieve itself in such a position. This was the cause of death assigned at the inquest, and a similar cause would probably be more frequently found if the larynx were always examined in infants alleged to have been overlaid during sleep.

A new-born child may be suffocated by having its head held over noxious vapours, such as the exhalations of a privy or of burning sulphur; and it is here necessary to remind a medical jurist that other highly poisonous vapours, *e.g.* chloroform, may be used by a criminal without leaving any traces upon the body—except, possibly, that which may depend upon their peculiar odour. There are few of these cases of suffocation in which a medical opinion of the cause of death could be given, unless some circumstantial evidence were produced, and the witness were allowed to say whether the alleged facts were or were not sufficient to account for death. ('Annales d'Hyg.' 1832, vol. 1, p. 621.)

On the other hand, if it be even clearly proved that death has been caused by suffocation, it must be remembered that a child may be accidentally suffocated, and the crime of murder falsely imputed. Dr. J. M. Duncan, quoting the observations of Dr. Buhl, states that obstruction of the air-passages by mucous and other matters is a frequent cause of death in new-born children (p. 948). Among twenty-seven children dying in labour or shortly after birth, eleven were destroyed by obstruction of the air-passages with foreign matters, or presented this condition. Eight were born dead, and of those which were alive at birth, none survived the first day. In ten of the cases the obstruction was produced by a greenish or greenish-brown slimy mass (meconium and mucus) filling the larynx and windpipe. In two of the cases, in which the child died during delivery, air was found in the lungs, and in only one of these the air had been derived from the act of respiration during birth. ('Edin. Monthly Med. Jour.' April 1863, p. 924; also 'Med. Times and Gazette,' August 3, 1861, p. 117.) In Dr. Hicks's case (p. 948) the base of the tongue in a new-born child was so drawn down by spasmodic action as to close the glottis by pressing backwards the epiglottis. The child was saved by raising the epiglottis, when air rushed in, and breathing was established; but many must be born under similar conditions when no assistance is at hand. Cases of this kind, however, rarely give rise to charges of child-murder, as no air is found in the lungs. A child might be killed during delivery by pressure applied to the chest; this might be such as not to produce any mark of violence. If the child had not breathed, there would be nothing to indicate the mode of death; if air had entered the lungs, then the usual appearances would be found in these organs (p. 698). In dealing with a case of this kind, it should be remembered that a child with its head born, but detained in the outlet by the size of its shoulders, would die from pressure exerted on the chest by the vagina. It might have breathed, but be born dead with the marks of suffocation about it. There is another accidental cause of the death of a new-born child during delivery. The membranes or caul may be carried forward over the head and face, and the act of breathing thus mechanically prevented. If no assistance is at hand, the child, although born living, will die soon after birth in consequence of the prevention of respiration. If, when the dead body is found, the membranes are no longer there, the cause of the prevention of respiration would not be apparent. The child, although born living, would probably be pronounced to have been born dead. (See case by Mr. Hall, 'Med. Times and Gaz.' January 1863, p. 126.) The delivery of a child with a mask or caul around its head is not an unfrequent occurrence. In June 1862 Mr. Blenkinsop, of Warwick, communicated to me a case in which a child so born was allowed to perish by those who had access to it. The caul was simply not removed, so that breathing could not be set up. The child was mature and healthy. The lungs contained no air. There was congestion of the brain and lividity of the body, but no mark of violence. There was some evidence that the child had been born living, and the cause of death was the prevention of respiration by omission to do that which was necessary. As the medical evidence showed that the child had not breathed, the Coroner held that it had never had any (legal) existence, and that there was no ground for any further investigation. Dr. Hunter, who was well aware of the risk to which a woman might be thus exposed, observes in relation to this state of things:—'When a woman is delivered by herself, a strong child may be born perfectly alive, and die in a very few minutes for want of breath, either by being on its face in a pool formed by the natural discharges, or upon wet clothes; or by the wet things over it collapsing and excluding air, or drawn close to its mouth and nose by the suction of breathing. An unhappy woman delivered by herself, distracted in her mind and exhausted in her body, will not have strength or recollection enough to fly instantly to the relief of her child.' (Op. cit. p. 35.) It may be added that a primiparous female may faint or become wholly unconscious of her situation; or, if conscious, she may be ignorant of the necessity of removing the child, and thus it may be suffocated without her having been intentionally accessory to its death. In such cases, however, there should be no marks of violence on the body, or, if present, they should be of such a nature and in such a situation as to be readily explicable on the supposition of an accidental origin. (See case by Dr. Dohow, Horn's 'Vierteljahrschrift,' 1864, vol. 2, p. 123.)

An infant is very easily destroyed by suffocation. If the mouth and nostrils are kept covered for a few minutes, by the face being closely wrapped in clothes, asphyxia may come on without this being indicated by convulsions or any other marked symptoms (see p. 704). A suspicion of murder may arise in such cases; but the absence of marks of violence, with an explanation of the circumstances, will rarely allow the case to be carried beyond an inquest. Sometimes the body is found maltreated, with severe fractures or contusions on the skull, and marks of strangulation on the neck; concealed in a feather-bed or privy, or cut up and burnt. This kind of violence may properly excite a suspicion of murder, and lead to the belief that the allegation of death from accidental suffocation is a mere pretence. This, however, is purely a question for a jury, and not for a medical witness. Unless the case be of a glaring nature, the violence is considered to have been employed for the purpose rather of concealing the birth of a child than of destroying it. In the present day these cases of death from accidental suffocation, when properly investigated, can never involve an innocent woman in a charge of murder, although the facts may show in many instances that the death of the child was really due to great imprudence, gross neglect, or culpable indifference on her part.

The following case (the *Queen* v. *Mortiboys*), tried in 1841, will show that even when the evidence is strong against a person, the circumstances will be favourably interpreted. In this instance it was proved that the body of the child was discovered in a box containing wool; it was lying on its abdomen, with its face raised and its mouth open. A red worsted comforter had been passed twice round the neck, and was tied a second time in a single knot over the chin. In the mouth, which was open, was found a small quantity of fine flocks of wool. The medical evidence showed that the child had been born alive, the left lung being fully inflated. The brain was congested. There was no mark produced by the ligature on the neck, either externally or internally. Death was referred to obstructed respiration (suffocation), caused partly by the ligature and partly by the wool in the mouth; but the latter was considered to be the more active cause. In the defence it was urged that the ligature could not have produced strangulation, because the comforter was tied upon the chin—that the medical evidence showed the wool in the mouth to have been the immediate cause of death; this was probably taken into the mouth by the child itself in the instinctive act of breathing, and not put there by the prisoner for the purpose of suffocation. The child had probably been placed carelessly on a quantity of wool, into which it had sunk by its own weight, and this had caused its death. It is reported that the judge joined in this view, and in charging the jury said, that had the prisoner intended to choke the child with the wool, she would have inserted enough to fill its mouth. The prisoner was acquitted. In this case, admitting that the evidence did not bear out the charge of murder, still it is clear that death was caused by the child being placed on its face, with a ligature round the neck, in a close box filled with wool. Admitting the facts to have been as represented, there appears to have been in this case something more than an accident: for the prisoner must have known that a new-born infant was not likely to live long under such circumstances, and had the child been a week or a month old, she would probably have been convicted of manslaughter or murder. A case of alleged child-murder by suffocation has been reported by Dr. Easton. (Cormack's 'Journal,' Feb. 1845.) There is no doubt that the child in this case was suffocated by a quantity of mud being forced into its mouth and throat; its presence in the gullet was incompatible with its having entered by gravitation. In the case of *Macintyre* (Glasgow Aut. Circ., 1829), several small pieces of straw were found in the stomach of a child, of the same kind as those which were in the bed where the birth took place. In another case, reported by Dr. Littlejohn, it was found that a mass of dough, or bread-pulp, had been forcibly impacted in the throat and larynx of the child; it was found to be accurately moulded to the parts. ('Edin. Med. Jour.' Dec. 1855, p. 521.) In one instance a plug of flax was discovered in the mouth. ('Ann. d'Hyg.' 1863, vol. 2, p. 395.)

Post-mortem appearances.—These are fully described, in reference to adults, at page 698; and they are similar in new-born children, provided respiration has been fully performed. M. Tardieu attaches great importance to the discovery of subpleural ecchymoses in the lungs of children: he has also noticed small effusions of blood on the surface and in the substance of the thymus-gland. ('Ann. d'Hyg.' 1855, vol. 2, p. 379). If the lungs float on water, as the result of breathing, then the appearances described will be met with: but it is worthy of remark that in three instances M. Tardieu met with similar appearances in children whose lungs had not received air, and sank when placed on water. They were children prematurely born, and under conditions which prevented full vital development. One born in the Hospital of Riboisière uttered several cries, but, in spite of this, the lungs contained no air. The subpleural ecchymoses met with in children under these circumstances, are ascribed by M. Tardieu to the efforts made to breathe after birth (loc. cit.). Partial emphysema of the lungs is occasionally observed.

2. *Drowning.*—The fact of drowning cannot be verified by any appearances on the body of a child which has *not* breathed. Thus, if a woman caused herself to be delivered in a bath, and the child was forcibly retained under water (a case which is said to have occurred), it would of course die; but no evidence of the mode of death would be found in the body. [For a case in which a child was thus destroyed, probably, however, through accidental

circumstances, see Cormack's 'Edin. Jour.' Oct. 1845, p. 796.] After respiration, the signs of drowning will be the same as those met with in the adult. (See p. 625.) The main question for a witness to decide will be, whether the child was put into the water living or dead. Infanticide by drowning is by no means common; the child is generally suffocated, strangled, or destroyed in other ways, and its body is then thrown into water in order to conceal the real manner of its death. The fact of the dead body of an infant being found in water must not allow a witness to be thrown off his guard: although a verdict of 'found drowned' is so commonly returned in these cases; the body should be carefully inspected, in order to determine what was really the cause of death. All marks of violence on the bodies of children that have died by drowning, should be such as to have resulted from accidental causes. The throat and air-passages should be particularly examined.

It is not necessary that the *whole* of the body of a child should be submerged, in order that it may be destroyed by drowning: the mere immersion of the head in water, or the covering of the mouth by liquid, will suffice to produce the usual effects of asphyxia. The air-passages should therefore be examined for foreign substances which may be deposited in them. A case occurred in London in 1842, in which a woman attempted to destroy her child by immersing its head only in a bucket of water. The child was discovered and resuscitated. This mode of destroying children by drowning may easily deceive a medical man. He would commonly look for evidence of the submersion of the whole body, and if no pond or well were near he might, from the absence of well-marked post-mortem appearances, assign death to some natural cause. Dr. Lankester mentions the case of a woman who drowned her child, but who was acquitted at her trial on the ground that no water had been seen in the room; yet there were witnesses in court who had sworn before the Coroner's jury that water was in a pail in the room, and was taken away after the death of the child. ('Second Annual Report,' 1865, p. 23.) When the dead body of an infant is found in water, it does not necessarily follow that it has been destroyed by drowning; a special examination of the body will be required to determine this point. (See DROWNING.) Dr. Walther has published a case of interest in this respect, in Casper's 'Vierteljahrschrift' (1863, vol. 2, p. 259).

New-born children may be drowned or suffocated by being thrown into mud, or into the soil of a privy. Sometimes the child is destroyed by other means, and its body is thus disposed of for the purpose of concealment. Should there be a large quantity of liquid present, the phenomena are those of drowning. The liquid portion of the soil abounding in sulphide of ammonium may then be found, if the child was thrown in living, in the air-passages, gullet, or stomach. The mere discovery of soil in the mouth would not suffice to show that the child was living when immersed. The presence of foreign substances, such as dirt, straw, or ashes, in the air-passages, gullet, and stomach, has usually been taken as a medical proof of the child having been living when immersed in the dirt, &c., and that the substances had been drawn into the passages by inspiration or the act of swallowing. Here, however, there is a wide field for conflicting medical opinions. In *Reg.* v. *Allridge* (Derby Winter Assizes, 1859), the dead body of a child was found buried in a garden. On examination there was earth in the mouth and throat, as well as in both nostrils at the back part; and particles of earth were found in the windpipe and air-tubes as well as in the stomach. The medical witness referred the death to suffocation, and considered that the earth must have been inhaled. Another medical witness, called for the defence, affirmed that the earth might have been carried into the passages of the body accidentally by the percolation of water (in eight days), and that it had not found its way there by inhalation. The jury upon this acquitted the prisoner. Although the mouth and throat may thus accidentally receive foreign matters, it is improbable that earth should be carried into the air-tubes or stomach by rain-water. The child was probably thrust into the earth when it retained some power of breathing and swallowing, and the earth found in the mouth and throat might be assigned to the violence with which it was forced into the soil. The nature of the soil, and the circumstances under which the dead body is found, must materially guide a medical opinion in cases of this nature. This subject has been fully examined by Dr. Märklin (Casper's 'Vierteljahrschrift,' 1859, vol. 2, p. 32), and by Dr. Simeons, in the same journal (1860, vol. 2, p. 287; see also 'Ann. d'Hyg.' 1852, vol. 1, p. 464).

On these occasions, the defence may be:—1. That the child was born dead, and that the body was thrown in for concealment; but the medical evidence may show that the child had breathed, and had probably been born living. 2. It may be alleged that the child breathed for a few moments after birth, but then died, and that the female thus attempted to conceal the body. A medical witness may be here asked, whether a woman could have had power to convey the body to the place—a point which must, as a general rule, be conceded. 3. It is most commonly urged, that the woman being compelled to go to the privy, was there *delivered unconsciously* or unexpectedly; that her waters had broken in the watercloset, and that she had no idea of anything more having happened; or that the child had dropped from her, and was either suffocated or prevented from breathing. ('Med. Times and Gazette,' Dec. 21, 1861, p. 646.) All these circumstances may readily occur, but, on the other hand, the explanation may be inconsistent with some of the medical facts. (See a case by M. Adelon, 'Ann. d'Hyg.' 1855, vol. 2, p. 453: also Casper's 'Klinische Novellen,' 1863, p. 585.) Thus the head or the limbs of a child may be found to have been separated or divided by some cutting instrument, or a cord or other ligature may be found tightly bound around its neck, or there may be a tightly-fitting plug in the throat. Then, again, the body may be entire, but the umbilical cord may be *cleanly cut*. This would tend to set aside the explanation of the child having accidentally dropped from the female: because in such an accident the cord should be found *ruptured*. The practitioner should make a careful examination of the divided ends of the cord by the aid of a lens, or a rupture may be mistaken for a section with a sharp instrument. Mr. Higginson, of Liverpool, has published a case of some interest in this point of view. The child fell from the mother, and the cord broke spontaneously. 'The torn ends were nearly as sharp-edged and flat as if cut.' ('Med. Gaz.' vol. 48, p. 985.) This case goes to prove that a careless or hasty examination of the ends of the cord may lead to a serious mistake. Sometimes the mark of a previous cut may be found on the cord near one of its divided ends—the first cut with scissors not having effectually divided it. In a case tried at Lewes Lent Assizes, 1852, Mr. Gardner proved, in reference to the body of a child which had been found in a privy, that the cord had been ineffectually cut in one spot previous to its complete division in another part. The cord had also been pulled out after this cut, so as to elongate the vessels; hence they projected from one part of the sheath at one cut portion, while they were retracted in the other. This accurate observation showed not only that the cord had not been ruptured by the child accidentally falling from the mother, but it served to establish the identity of the placenta, which was found concealed at a distance from the body. When the cord is lacerated, this will be, *cæteris paribus*, in favour of the woman's statement as to the mode in which her delivery occurred. (For a case involving this question, see 'Med. Gaz.' vol. 10, p. 374.)

In a case which occurred to Dr. Wharrie, in which the child fell from a female while sitting over a large jug containing water, and from the state of whose lungs it was evident there had been no respiration, the cord was found tied. The child was removed from the vessel dead; therefore the ligature must have been applied after death. Drowning may be the result of accident from sudden delivery. A woman in an advanced state of pregnancy, while sitting on a chamber-vessel, was suddenly delivered. The child fell into the fluids in the vessel, and before assistance could be rendered, it was dead. In December 1864 Mr. Parker, of Liverpool, communicated to me the following case:—A woman who had already had two illegitimate children delivered herself of a third, and alleged that it was still-born. Mr. Parker examined the body of the child, which was of average size. The head and face were much congested, and there was a slight oozing of bloody fluid from the nostrils. The eyelids were discoloured; the lips were separated, swollen, and livid; the chest was arched. The navel-string had been cut but not tied, and there was a slight oozing of blood from it. The lungs had all the usual fœtal characters; they sank in water when cut into small pieces. There was dark fluid blood in the heart and large vessels. It came out in evidence, at the inquest, that the woman was delivered while sitting on the chamber-utensil, when the whole contents of the uterus at once passed from her—the child and afterbirth with the waters. A neighbour came in and placed the woman in bed, but omitted to look to the child, which was soon afterwards found dead. Mr. Parker stated in his evidence that the child had not breathed. His conclusion was that it had probably been born alive, but had died from prevention of breathing at its birth, owing to the want of proper attention. There is no doubt that many children are thus born alive, but do not continue to live after birth, owing to the accidental or criminal prevention of respiration. Such cases are always open to the suggestion that they arose from accident, and it is right that a woman charged with child-murder should have the full benefit of them. Two instructive cases are reported by Dr. Carson, of Coleraine, which show that, alone and unassisted, the mother of an illegitimate child may be placed under circumstances of the greatest suspicion, although innocent of any attempt to destroy the life of her child. ('Med. Times and Gazette,' Jan. 26, 1861, p. 99; see a case in Casper's 'Vierteljahrschrift,' 1859, vol. 2, p. 36; also in Horn's 'Vierteljahrschrift,' Jan. 1865, vol. 1, p. 40.)

Circumstantial evidence.—Whether, in any instance, the *drowning* of a child was accidental or criminal, must be a question for a jury to determine from all the facts laid before them. The situation in which the body of an infant is found may plainly contradict the supposition of accident. On the other hand, a child may be accidentally drowned by its mouth falling into a pool of the discharges during delivery, although this would be rather a case of suffocation. The throat, windpipe, and stomach of the child should always be examined on these occasions, as mud, sticks, straw, weeds, or other substances, may be found, indicating, according to circumstances, that the child had been put into the water living, and that it had been drowned in a particular pond or vessel.

3. *Cold.*—A new-born child may be easily destroyed by simply exposing it uncovered, or but slightly covered, to a cold atmosphere. In a case of this kind there may be no marks of violence on the body, or these may be slight and evidently of accidental origin. In death from cold the only appearance occasionally met with has been congestion of the brain, with or without serous effusions in the ventricles. (See Cold, p. 741.) The evidence in these cases must be purely circumstantial. The medical witness may have to consider how far the situation in which the body was found,—the kind of exposure, and the temperature of the air, would suffice to account for death from the alleged cause. There is no doubt that a new-born child is easily affected by a low

temperature, and that warm clothing is required for the preservation of its life. An inspection of the body should never be omitted on these occasions, because it might turn out that there was some latent cause of natural death which would at once do away with the charge of murder. Admitting that the child died from cold, it becomes necessary to enquire whether the prisoner exposed it with a malicious intention that it should thus perish. Unless wilful malice be made out, the accused cannot be convicted of murder. In general, females do not expose their children for the purpose of destroying them, but for the purpose of abandoning them: hence it is rare to hear of convictions for child-murder where cold was the cause of death, although some medical jurists have called this infanticide by *omission*, an offence which does not appear to be recognized by the English law. In the case of the *Queen* v. *Walters* (Oxford Autumn Assizes, 1841), it was proved that the prisoner, while travelling in a waggon, had suddenly left the vehicle, and that she was delivered of a child, which was afterwards found dead and exposed on the road. There was no doubt that the child had been born alive; for it was heard to cry after it was abandoned by its mother, who appeared to have carried it some distance after it was born. The child had died from exposure to cold. The woman was convicted of manslaughter, and sentenced to ten years' transportation. (For other medico-legal cases of death from cold, see Henke's 'Zeitschrift,' 1836; also, 1840, vol. 1, p. 168, Erg. H.) In the case of *Reg.* v. *Waters* (Exchequer Chamber, Jan. 1849), the judges held on appeal that the count which charged the prisoner with causing the death of her child by throwing it on a dust-heap, and leaving it exposed, was good, and the conviction was affirmed.

4. *Starvation.*—A new-born child kept long without food will die, and no evidence of the fact may be derivable from an examination of the body. There may be no marks of violence externally, nor any pathological changes internally, to account for death. This is a rare form of murder, except as it may be accidentally combined with exposure to cold. In order to convict the mother, it is necessary to show that the child was wilfully kept without food, with the criminal design of destroying it. Mere neglect or imprudence will not make the case infanticide. The only appearance likely to be found on examination of the body would be complete emptiness of the alimentary canal. Without corroborative circumstantial evidence, this would not suffice to establish the cause of death: a medical witness could only form a probable conjecture on the point. In a suspected case of this kind, the contents of the stomach should be tested for farinaceous and other kinds of food. (See STARVATION, p. 745.)

5. *Immaturity in cases of abortion.*—From the case of *Reg.* v. *West* (Nottingham Lent Assizes, 1848), it would appear that if by the perpetration of abortion, or the criminal inducement of premature labour, a child be born living at so early a period of uterine life that it dies merely from *immaturity*, the person causing the abortion, or leading to the premature birth, may be tried on a charge of murder. A midwife was alleged to have perpetrated abortion on a female who was between the fifth and sixth months of pregnancy. The child was born living, but died five hours after its birth. There was no violence offered to it; and its death appeared to be due entirely to its immaturity. The prisoner was acquitted, apparently on the ground that abortion might have arisen from other causes.

Among those cases of violent death which leave on the body of the child certain marks or appearances indicative of the cause, may be mentioned wounds, strangulation, and poisoning.

6. *Wounds.*—Probably this is one of the most frequent causes of death in

cases of infanticide. Wounds may, however, be found on the body of a child which has died from some other cause. The principal questions which a medical witness has to answer are:—1. Whether the wounds were inflicted during or after birth, or, to adopt the legal view of the matter, before or after the child was *entirely* in the world in a living state: for, according to the decisions of our judges, a child is not considered living in law, at least its destruction does not appear to be *murder*, until the body is entirely born from the body of the mother. In most cases it will be utterly impossible for a medical witness to return any answer to a question put in this form. All that medical evidence can pretend to show is, whether a child was living or not when the wounds were produced: for whether the *whole* of its body was or was not in the world at this time, they will possess precisely the same characters. In a few cases only, a conjectural opinion may be formed from the nature, extent, and situation of these injuries.—2. The witness will be required to state, whether the wounds were inflicted before or after death.—3. Whether they were sufficient to account for death.—4. Whether they originated in accident or criminal design. The child may have deen destroyed by *burning*, and evidence must then be sought for by an examination of the state of the skin. All these questions have been fully considered in treating the subject of Wounds (p. 374), and they therefore do not require any further notice in this place.

A case of infanticide was tried at the Buckingham Summer Assizes, 1840 (the *Queen* v. *Wood*), in which the main question was, whether five severe wounds found on the head of a child were inflicted before or after death, and accidentaly or criminally. The mother confessed that the child was born alive and had cried, but that it had died in five minutes after its birth. Its body was buried, and it was assumed that the wounds might have been accidentally inflicted after death by a spade which had been used for the burial. The medical witness attributed death to the wounds, which, in his opinion, could not have been accidentally produced; but he very properly admitted, in cross-examination, that the wounds would have presented the same appearances had they been inflicted immediately after death, while the blood was in a fluid state. Answers to questions of this kind can of course be given only in those cases in which the body has been examined soon after the infliction of the wounds. It would be extremely hazardous to pronounce an opinion when the child has been long dead. In the case of the *Queen* v. *Taylor* (York Lent Assizes, 1843), the child had been dead about a year, and when its body was found in a garret it was so much dried up that the medical witnesses were unable, with certainty, to state the sex. The left arm had been removed from the body, and on the throat was a cut extending nearly from ear to ear, which was considered to have been made by some sharp instrument; and from the retraction of the edges of the wound, the witnesses thought that it must have been produced during life or immediately after death. The prisoner was acquitted. In this case there do not appear to have been any good medical reasons for the opinion expressed respecting the time at which the wound had been caused. Certainly, the retraction of the edges could furnish no evidence in a wound produced a year before, in a body so dried up as to render the recognition of the sex difficult. This may have been a case of child-murder, but there was no medical proof of it: it was not even proved that the child had come into the world living.

Incised wounds found on the bodies of children may be referred to the use of a knife or scissors by the prisoner in attempting to sever the navel-string, and they may therefore be due to accident. This point should not be forgotten, for a wound even of a severe kind might be thus accidentally inflicted. In such cases we should always expect to find the navel-string *cut*, and not lacerated. The end of it may, for the purpose of examination, be stretched out on a piece of white card. In the case of the *Queen* v. *Wales* (Central Criminal Court, Sep. 1839), it was proved that there was a wound on the right side of the neck of the child, not involving any important vessels, although it had caused death. The medical witness allowed that it might have been accidentally inflicted in the manner suggested, and the prisoner was acquitted. As this question may be unexpectedly put at a trial, a witness should prepare himself for it by a careful examination of the wound and of the navel-string. This will in general suffice to show whether an incised wound has been produced accidentally in the manner alleged, or by criminal design. Intra-uterine wounds have been in some cases met with. Dr. Priestley has described one which involved a part of the scalp. ('Med. Times and Gaz.' March 12, 1859.)

Marks of external violence, however slight, should not be overlooked: minute punctures or incisions externally may correspond to deep-seated injury of vital organs. The spinal marrow is said to have been wounded by needles or stilettoes introduced between the vertebræ, the skin having been drawn down before the wound was inflicted, in order to give it a valvular character, and to render it apparently superficial. The brain is also said to have been wounded, by similar weapons, through the nose on the thinner parts of the skull (the fontanelles).

In some instances the body of a child is found cut to pieces, and the allegation in defence may be that the child was still-born, and the body thus treated merely for the purpose of concealment. Dr. Toulmouche has reported a case of this kind, which was the subject of a trial in France in 1852. As the woman had not destroyed the lungs, experiments on these organs gave satisfactory results of perfect respiration. The cavities of the heart and great vessels were empty: the body was generally drained of blood, and the skin throughout very pale. This led to the inference that the mutilations must have been inflicted while the child was living; and as all the parts were healthy, and no natural cause of death apparent, Dr. Toulmouche ascribed the death of the child to the wounds. The woman was convicted, and condemned to twenty years' confinement in the galleys. ('Ann. d'Hyg.' 1853, vol. 2, p. 200.) In this country she would probably have escaped under a verdict of 'concealment of birth,' and have been sentenced to a year's imprisonment.

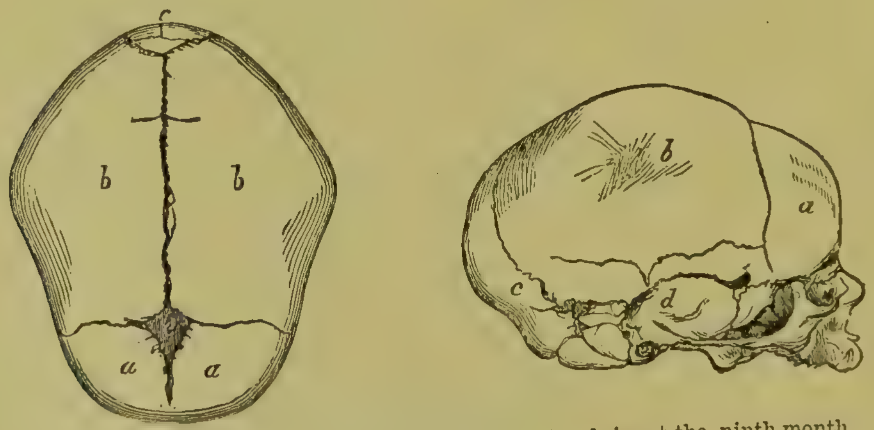
Marks of violence on the head.—It has been elsewhere remarked (*ante*, p. 946) that during a protracted delivery there is formed on the head of a child a tumour containing either serum, blood, or a mixture of the two. Non-professional persons may, when a woman has been secretly delivered, ascribe a tumour of this kind to violence, whereas it may really have been produced by natural causes. The tumour is generally situated on one of the parietal bones, its situation depending on that part of the body which presents during delivery. After the discharge of the waters, the scalp is firmly compressed by the mouth of the uterus, and subsequently by the os externum. This pressure interferes with the circulation through the skin, and causes the compressed portion of the scalp to swell. In the simplest form of this tumour serum only is found in the swollen part: occasionally this is mixed with blood, and there are small ecchymoses of the scalp, as well as of the pericranium and skull, but there is generally no injury to the bones, nor is there any laceration of the skin externally. In other cases blood is found effused in the tumour either under the scalp, the membrane covering the skull (pericranium), or within the skull itself. The term *Cephalæmatoma* or *Caput succedaneum* is applied to tumours which have this natural origin, p. 946. The sanguineous variety is more likely to be confounded with the effects of violence than the serous tumour; but it is identified by the scalp being always uninjured, although this may present redness and lividity. Violence from blows or falls which would produce bloody effusions beneath the scalp, or within the skull, would in general be indicated by injury to the skin or by fracture of the bones. At the same time the following case, which occurred to Dr. West, shows that caution is required in forming an opinion.

In this case the child died twenty-three days after birth. The tumour (cephalæmatoma) was about the size of a walnut originally, but it extended so as nearly to cover the right parietal bone. On dissection it was found to be filled with coagulated blood, beneath which was a layer of dense fibrinous matter. The right parietal bone presented a fissure with clean edges running from the coronal suture obliquely backwards and upwards. On the inner surface of the bone was an effusion of blood between the cranium and dura mater more than half an inch in thickness, and occupying the whole of the hollow of the parietal bone. There was no reason to doubt that the fracture and effusion were the results of compression during delivery; they had not been occasioned by external violence. ('Trans. of Med. Chir. Soc.' vol. 28: see, for further information on this subject, 'Churchill on the Diseases of Children,' p. 66.)

Fractures of the skull.—The only injuries to the head which require to be specially considered in relation to infanticide, are fractures of the skull; and here the question to which we may chiefly confine our attention is, whether the fracture arose from accident or criminal violence. The rules for determining whether these injuries were inflicted during life or after death have been elsewhere considered. (See WOUNDS, p. 374.) Dr. Adamkiewicz has published some remarks on this subject, in reference to a case which came before him, in Horn's 'Vierteljahrschrift,' 1864 (vol. 2, p. 211).

Although it has been a matter of frequent observation, that great violence may be done to the head of a child during parturition without necessarily giving rise to fracture, yet it is placed beyond all doubt that this injury may occur by the expulsive efforts of the uterus forcing the head of a child against the bones of the pelvis. Even the violent compression which the head sometimes experiences in passing the mouth of the uterus, may suffice for the production of fracture. (See 'Edin. Med. and Surg. Jour.' vol. 26, p. 75.)

FIG. 1. FIG. 2.



The skull of the child reduced to one-third of the natural size at the ninth month.
Fig. 1. View of the vertex. Fig. 2. Lateral view.

For the better understanding of the description of these injuries, illustrations are annexed. These represent the skull of a child at maturity; they are taken from specimens in the Guy's Hospital Museum. *a a*, the frontal bone, divided by a suture in the centre: *b b*, the parietal bones (most commonly the seat of fracture), separated from each other by a line which marks the course of the sagittal suture. Another line marks their separation from the frontal bone;

this represents the course of the coronal suture: *c*, the occipital bone, separated from the parietal bones, *b b*, by the lambdoidal suture: *d*, the squamous plate of the temporal bone: *e*, the anterior fontanelle—a space between the parietal bones and the frontal bone. The shaded space represents the membrane which at this age supplies the place of bony matter. The posterior fontanelle is situated between the two parietal bones and the occipital bone: it is here scarcely seen, owing to the aspect in which the skull is viewed.

Is was formerly supposed that fractures of the skull in new-born children were always indicative of criminal violence; but cases which have occurred in obstetric practice have established the certainty of their accidental occurrence. These accidental fractures, it is to be observed, are generally slight; they commonly amount merely to fissures in the bones, beginning at the sutures, and extending downwards for about an inch or less into the body of the bone. According to Dr. Weber, the frontal and parietal bones are the only bones liable to be fissured or fractured during the act of parturition. ('American Jour. Med. Sci.' Jan. 1853, p. 254; and American edition of the 'Manual of Medical Jurisprudence,' by Dr. Hartshorne.) In the greater number of cases reported, the parietal bones only have presented marks of fracture.

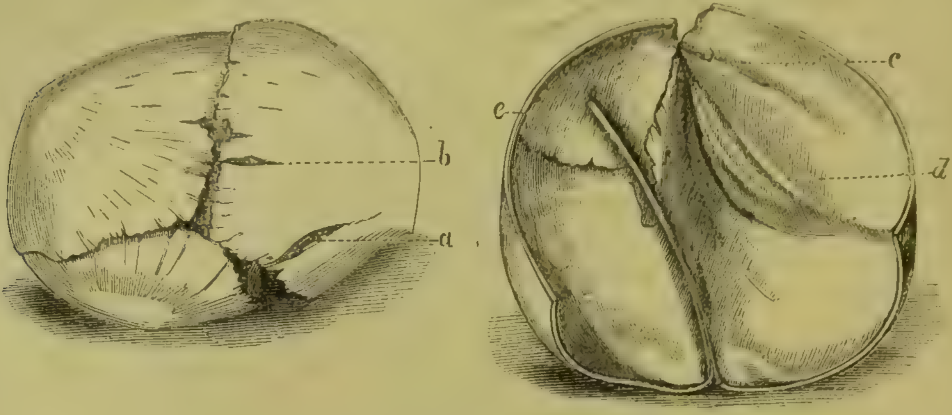
The most complete history of these accidental injuries to the skull of a new-born child has been given by Dr. Schwörer, of Freiburg. ('Beyträge zur Lehre von dem Thatbestande des Kindermordes, &c., nebst Mittheilung eines Falles von tödtlichem, während der Geburt, ohne Einwirkung äusserlicher Gewalt entstandenem Schädelbrücke eines Kindes.' Freiburg, 1836, p. 38.) In one instance, he himself delivered a woman after a labour of twenty-seven hours. While the head of the child was at the outlet the uterine contractions ceased for an hour; the child was then suddenly expelled, and Dr. Schwörer received it in his hands, so that its body did not come in contact with anything that could produce physical injury. The child did not breathe when born, but it showed evident signs of life. The pulsations of the heart and umbilical cord were distinctly perceived; these gradually ceased, and no effort could restore the child or bring about respiration.

It may be remarked, in reference to this state of life without breathing, that on an inspection of the body the lungs contained no air; there was no crepitation when the substance was cut, and they sank in water not only in the entire state, but when divided into numerous pieces. This adds another to the now accumulated observations showing that a child may be *born alive* without crying and without breathing, and it demonstrates the error of resting the proof of life after birth upon breathing alone. (See pp. 798 and 905.) Those medical jurists who adopt the view that independent life and breathing are synonymous terms, would have pronounced this child with an audibly pulsating heart to have been born dead; but had the efforts to recover it been successful, they would have affirmed that it had been born living!

The most important fact connected with the body, was the condition of the head. There was a considerable swelling of the skin at the top of the head, chiefly over the right parietal bone, and beneath this a quantity of dark-coloured blood was effused. Two fissures or slight fractures were perceived in this bone—one passing from the sagittal suture towards the centre of the bone, about half an inch in length (*b*. fig. 1, p. 962); and a second, about an inch long (*a*), passing from the lambdoidal suture at the back part of the parietal bone, also towards the centre. There was no doubt that these fissures or fractures in the bone, with the effusion of blood beneath, were produced by the action of the uterus alone during delivery.

The annexed engravings are taken in a reduced form from those given by Schwörer. Fig. 1 represents the exterior of the bony skull, and fig. 2 the interior: *c* shows the appearance of the principal fissure on the inside: *d* represents the situation between the two fissures of an effusion of blood, amounting to about two drachms in a coagulated state—it was between the arachnoid membrane and the dura mater: *e* indicates the course of the longitudinal sinus or great bloodvessel.

Fig. 1. Fig. 2.



Fractures of the fœtal skull during birth.

External view. Internal view.

From these appearances, and an absence of the knowledge of the facts, Dr. Schwörer considers that the following conclusions would have been drawn:—1st, that this child was born capable of living, and probably lived after its birth; and 2ndly, that it had died a violent death from injuries inflicted on the head. A woman delivered of an illegitimate child in secret might, although innocent, have thus been compromised in a charge of murder (op. cit. p. 44). As the lungs sank in water entire and divided, it is highly probable that in this country the case would have been stopped by a coroner's jury, on medical evidence that the child was still-born. Supposing, however, that further proceedings had been taken, the amount of violence to the head was comparatively too slight to justify a medical opinion that it absolutely indicated an act of murder. The bones were merely fissured, not dashed in or displaced, and the brain was uninjured; the fissures were slight, and the amount of blood effused was very small for an act of homicidal violence involving the skull. Dr. Schwörer is right in suggesting that such cases should inspire caution in giving medical opinions; but medical men are, at least in the present day, prepared to make full allowance for the accidental occurrence of such injuries as these during labour.

A case is reported in Casper's 'Wochenschrift' (Oct. 1840), in which about half-a-drachm of blood was effused on the right parietal bone, which was compressed in the centre, and presented a radiated fracture. Clots of blood were found on the dura mater. (See also 'Brit. and For. Med. Rev.' vol. 21, p. 254, and vol. 7, p. 333.) In a third case, where there was deformity of the pelvis, the child was born dead, and there were two fissures, about an inch long, in the left parietal bone; and both parietal bones were considerably flattened. (Casper's 'Wochenschrift,' Sept. 1837.) Dr. West has reported the following case of spontaneous fracture of the left parietal bone, which occurred to Dr. Götz, during a natural but tedious labour, in which the head of a child was five hours in the pelvic cavity, although the pelvis was well-formed. There were three fissures in the bone—one running into the sagittal suture, one to the anterior inferior angle, and the other to the middle of the anterior edge of the bone. The child was still-born. Much blood was effused beneath the scalp, but none under the skull. ('Med. Gaz.' vol. 39, p. 288.)

In respect to these accidental fractures and effusions of blood from uterine action, it may be remarked that they are in general recognized by their very slight extent. In cases of murder by violence to the head, the injuries are commonly much more severe: the bones are driven in, the brain protrudes, and the scalp is extensively lacerated. Such severe injuries as these cannot arise accidentally from the action of the uterus during parturition. See report of a case by Dr. Wiseman, in which, in addition to severe injuries to the brain, coal-dust and minute pebbles were found driven into the skin of the head by the body being thrown from a height. ('Edin. Med. Jour.' Dec. 1855, p. 492.) In these cases, however, it may be fairly urged, that the woman was unexpectedly seized with labour, that the child was expelled suddenly by the violent efforts of the uterus, and that the injuries might have arisen from its head coming in contact with some hard surface—as a floor or pavement. It must be admitted that a woman may be thus suddenly and unexpectedly delivered while in the erect posture, although this is not common among primiparous females; and that injuries may be thus accidentally produced on the head of a child.

Sudden delivery. The pains of labour mistaken for other sensations.—In cases like that reported by Dr. Wharrie (p. 955), where a female, under the impression that she was about to have a motion, sat over a large water-jug and was delivered of a child, it is proper to make full allowance for a mistake which may be compatible with innocence. A woman is often unable to distinguish the sense of fullness, produced by the descent of a child, from the feeling which leads her to suppose that she is about to have an evacuation: and thus it is dangerous, when a labour has advanced, to allow a female to yield to this feeling, for there is nothing more probable than that the child will be suddenly born. Mr. Rankin, of Carluke, has reported two cases of this description, where there could not be the slightest suspicion of criminality. In one, a primipara, the child was actually born under these circumstances, but its life was fortunately saved; had there been no other convenience than a privy, it must have been inevitably lost. In the second, although a case of third pregnancy, the female was equally deceived by her sensations. ('Edin. Month. Jour.' Jan. 1846, p. 11; see also a case in which twins were thus born, 'Med. Times and Gaz.' March 2, 1861, p. 235.) It is true that this alleged mistaken sensation forms a frequent and specious defence on charges of child-murder; but still a medical jurist is bound to admit, that an accident which occurs to females of the middle class, may also occur to the poor without necessarily implying guilt. (For a case of rapid delivery in a primipara, see 'Med. Times and Gazette,' Feb. 6, 1858; also *ante*, p. 956.)

Power of exertion in recently-delivered females.—On these occasions, a witness will often find himself questioned respecting the strength or capability for exertion evinced by the lower class of women shortly after childbirth. Dr. Alison remarks, that many respectable medical practitioners, judging only from what they have observed among the higher ranks, are liable to be led into an erroneous opinion, which may affect their evidence. He mentions a case, in which a woman accused of child-murder walked a distance of twenty-eight miles in a single day, with her child on her back, two or three days after her delivery. (Case of *Anderson*, Aberdeen Spring Circ. 1829.) Instances have even occurred in which women have walked six and eight miles, on the very day of their delivery, without sensible inconvenience. ('Criminal Law,' p. 161.) In one case (*Smith*, Ayr Spring Circ. 1824), the woman was engaged in reaping,—she retired to a little distance, effected her delivery by herself, and went on with her work for the remainder of the day, appearing only a little paler and thinner than usual! In the case of *Macdougal* (Aberdeen Spring Circ. 1823), the prisoner, who was sleeping in bed with two servants, rose, was delivered, and returned to bed without either of them being conscious of what had occurred. Cases like the last have often presented themselves in the English Courts. A firm resolution, with a desire to conceal her shame, may enable a woman to perform, immediately after her delivery, acts connected with the disposal of the body of her child, which, from ordinary experience, might appear to be much beyond her strength.

A case of sudden delivery *in the erect posture* in a primiparous female, without injury to the child, is reported by Dr. W. Burke Ryan, in the 'Lancet' (June 21, 1845, p. 707). The umbilical cord was, in this instance, ruptured at the distance of about two inches from the navel. This gentleman has communicated to me the particulars of a second case, which occurred in his practice in October 1852. A woman who had borne a child was suddenly delivered while standing. The child fell to the floor on its vertex, and the cord was ruptured. A small quantity of blood escaped from the part struck, but there was no open wound or fracture of bones, and the child sustained no injury. In another case of a primiparous female, sudden delivery took place while the woman was in the act of sitting down. The child was forcibly expelled, and fell with its head on the floor of the room; it was taken up dead, the cord being still attached to it and the placenta, which came away shortly after the birth of the child. ('Med. Gaz.' vol. 37, p. 808.)

It appears, from cases collected by Dr. Klein, that fractures of the skull even under these circumstances are of rare occurrence. Out of 183 cases reported by him, in which the women were rapidly delivered while sitting, standing, or inclined on the knees—the child falling on the ground or floor—there was only one instance in which a child was killed; and there was not a single instance in which the bones of the skull were fissured or fractured, so far as could be ascertained by external examination. (Devergie, vol. 1, p. 631; Briand, p. 271.) Chaussier performed some experiments on the bodies of still-born children, allowing them to fall with their heads downwards on a paved floor, from a height of eighteen inches: and he found that, out of fifteen cases, one or other of the parietal bones was fractured in twelve. Although these results are conflicting, yet Klein's observations appear more to the purpose; because they were made under circumstances in which the question would really arise in a case of infanticide. They are strikingly supported by the following case, which occurred to Mr. Blacklock. ('Lancet,' July 26, 1845.) A married woman was suddenly delivered while standing: the child fell to the floor, but sustained no injury; the navel-string was ruptured close to the navel. (See also Dr. Ryan's case, *supra.*) A case analogous to these, also in a primipara, is reported in the 'Gazette Médicale' (26 Juin 1847). A woman, æt. 27, was delivered of a child while in the act of walking to an hospital, at the distance of a mile. She stated that she had lost a large quantity of blood. The child, which she brought in her apron, was mature and living: the navel-string had been ruptured close to the abdomen. (See also another case by Dr. Pickford, 'Med. Gaz.' vol. 42, p. 731.) A more recent case has been reported by Mr. Dermott. ('Lancet,' March 12, 1853, p. 245.) A young married woman, æt. 23, pregnant of her first child, was delivered suddenly while in the erect posture. The child, which was healthy and full-grown, fell upon the floor, and the cord was broken off within three inches of the navel; it was separated as cleanly as if it had been divided by an accoucheur. Excepting the production of a swelling on the forehead from a bruise, the child had sustained no injury by this sudden expulsion. A similar case occurred to Dr. Chevers. ('Med. Jur. for India,' 1856, p. 523.) Dr. Coleman ('Lancet,' Oct. 1, 1864, p. 377) met with a case in which a married woman, while standing by the window of her bedroom, was suddenly delivered in his presence; she had had no warning pains, and up to an hour of her delivery had been quite well. The child had fallen on the floor, but sustained no injury; the navel-string was ruptured at one inch from the abdomen; it was bleeding, but this was soon stopped by a ligature. The mother and child did well. Mr. Twitchell met with a case in which a young woman, æt. 17, was suddenly delivered while engaged in ironing. The child fell on the floor, rupturing the cord three inches from the umbilicus, but sustained no injury. ('Lancet,' 1864, vol. 2, p. 477.) M. C., æt. 23, single, was suddenly delivered of a full-grown male child at 5.30 a.m., January 5, 1864. She stated that between 4 and 5 a.m. she felt griping pains. She suspected that her labour was coming on, and she walked to a friend's house, at 600 yards' distance, to be confined. When she had proceeded halfway, she was suddenly delivered, while in the erect position, and her child fell upon the pavement. The navel-string was ruptured transversely four inches from the navel, and the placenta was expelled. She walked to the place where she intended to be confined, carrying the child, which she had wrapped in a petticoat. In about half an hour she was seen by a surgeon; he found her in bed looking perfectly well, free from pain, and merely complaining of cold. This was her first child; it was well nourished and healthy-looking. The only injury which it had sustained by the fall was on the left parietal bone, at the junction with the coronal suture; there was here a soft tumour between two and three inches in its transverse diameter, which was slightly ecchymosed. Both mother and child did well, and the tumour entirely disappeared at the end of three weeks. The cord had been tied after the woman's arrival at the house. ('Lancet,' vol. 1, 1854, p. 637.) (For another case in which twins were suddenly born without any previous warning, see 'Medical Times and Gazette,' March 2, 1861.) These observations lead to the inference that such accidents are not likely to occur, yet we cannot deny the *possibility* of their occurrence: therefore a barrister is fully justified in endeavouring upon this ground to exculpate a person charged with child-murder.

Dr. Swayne, of Bristol, has published in the 'Association Journal' (Oct. 14, 1853, p. 901) a case which shows that a fracture of the skull of a child may occur when a woman is delivered in the erect posture. In this instance there was merely the appearance of a bruise on the head, and the cord was ruptured (not cut) three inches from the navel. The child did not suffer from the fall, and continued well until six days after its birth, when it was seized with convulsions and died. A fissure of about an inch and a half in length was found in the upper part of the left parietal bone. A clot of blood was found in this situation between the dura mater and bone, and there was congestion of the vessels of the membranes; with this exception there was no morbid appearance in the body. Dr Porter Smith, of Bath, communicated to me a case, which occurred in November 1856, in which the facts were similar to those above related. In consequence of the concealment of the body, however, the mother was charged with the murder. The right parietal bone was fractured, and there was effusion of blood internally, but there was no mark of external violence. The cord had been ruptured at a distance of two-and-a-half inches from the navel. The stomach of the child contained the usual albuminous and mucous matters of the fœtal state, without any appearance of food. The lungs were inflated and highly crepitant; the foramen ovale and the ductus arteriosus were in their fœtal condition. The child had probably been drowned in the discharges from want of assistance at the time of birth. The woman, who admitted that the child fell from her suddenly, was acquitted. Dr. Olshausen has published four cases of sudden delivery, in each of which the child dropped from the woman, and in two of them there were fissures in the parietal bones. The children recovered from the effects of the accidents. ('Med. Times and Gazette,' Sept. 1860; 'Am. Jour. Med. Sci.' Jan. 1861, p. 279.) Other cases of rapid delivery in the erect posture are reported in the 'Lancet' (Jan. 5, 1861, p. 13). In these there was no injury to the child, although in one case the delivery took place on the deck of a vessel.

A medical witness would find no difficulty in determining the probability of this explanation of the accidental origin of such fractures, if he were made acquainted with all the facts connected with the delivery. But the acquisition of this knowledge must be accidental; and it will, in general, be out of his power to obtain it. Sometimes the fractures will be accompanied by incisions, punctures, or lacerations of the scalp or face: in such cases, although the origin of the fractures might be accounted for by the alleged fall during parturition, the cause of the other injuries would still remain to be explained. (See the case of the *Queen* v. *Reeve*, Cent. Crim. Court, Feb. 1839, and the *Queen* v. *Stevens*, Bodmin Lent Ass. 1845.) Injuries of this nature, with the fact that there are bruises or contusions as well as fractures not connected with each other in various parts of the skull, and depending on different acts of violence, would be inexplicable on the hypothesis of an accidental fall. I am indebted to Mr. Kesteven, of Holloway, for the following case:— An inquest was held in February 1854, on the body of a female infant, of which a young woman had been delivered on the 21st of December 1853. The infant had been born, according to the statement of the mother, in the pan of a watercloset on the ground-floor of the house, and was afterwards carried by her up two pair of stairs, and placed beside her in bed. She admitted that the child had been born alive, but stated that it was dead when she lifted it up from the pan to carry it to the bedroom. The navel string was torn at the distance of four inches from the abdomen. The child, she alleged, had fallen into the watercloset pan. No trace, however, of blood or other discharge was found on or near the seat of the closet; while upon the opposite side of the chamber the floor was stained with blood, which had been imperfectly wiped up. On on examination of the body of the infant, it was found to be a well-formed mature child, weighing seven pounds. The lungs had been fully expanded to their margins, covering the heart, and floating in water with or without the latter organ. The scalp presented no trace of injury; there was only the usual tumour, and on dividing the skin there was some ecchymosis at this part. The bones of the skull were found extensively fractured. There was a horizontal fracture nearly an inch long over each orbital prominence; upon the right frontal eminence the bone was broken and depressed, in an acute triangular form, three-quarters of an inch in length. The parietal bones on each side were fractured vertically from their eminences downwards, to the extent of an inch and a quarter; on the left side the lower end of this fissure was joined by another of similar extent, passing horizontally forwards at a right-angle to the edge of the bone. Several smaller fractures were found at different parts of the upper surface of the skull; they were not apparently connected with each other. Within the cranium, blood was extravasated on the surface of the brain, and in the membranes. No fractures were detected at the base of the skull. The mother alleged that the injuries to the head were owing to the child having fallen into the pan of the closet. This explanation, however, was inadmissible, as it was very doubtful whether the body of the child had been in the pan at all. Even supposing the child to have thus fallen, the distance was too small to have caused such an amount of injury situated on various parts of the skull; besides which, as the child would have passed in an oblique direction forwards from the outlet, it would have glided safely down by the side of the pan. In the absence of evidence as to the mode in which the injuries were inflicted, it was suggested that they might have been caused by the mother having fallen upon the child on her way upstairs; and this hypothesis was ultimately adopted by the coroner's jury. There was no doubt that the child's death was caused by the injuries to the head; and the jury took what is called a lenient view of the facts, in rejecting the woman's explanation of the cause of the violence, and in assuming that such a variety of severe injuries to the bones of the head could have been produced by the mother falling upon the body of the child. (See another case in 'Med. Times and Gaz.' April 4, 1857, p. 347.) In *Reg.* v. *Gibson* (Gloucester Assizes, 1864), the medical evidence was to the effect that the skull of the child was fractured and much blood was effused on the brain. The right lung contained air—and the left lung also, but in smaller quantity; they floated on water. The prisoner admitted to the witness that the child cried twice, and accounted for the fracture of the skull by asserting that the child had dropped from her in a lane. She wrapped it up, and soon afterwards found that it was dead. A stone having blood and hair upon it was picked up near the body. The prisoner was acquitted of the alleged murder. In *Reg.* v. *Strangeways* (C. C. C. Dec. 1864), there was not only a fracture of the right parietal bone, but the throat was cut, and, according to the medical evidence, with a knife. From the state of the lungs it was evident the child had breathed, but the medical witness declined to say that it had had an existence independently of the mother. The defence here was, that the child dropped from her while she was standing at her work, and that it fell on the kitchen fender. There were, however, no marks of blood on the fender, and the wound in the throat was inconsistent with such a statement.

The medico-legal importance of this subject will be further apparent from the evidence given in a case tried before the Criminal Court of New York in November 1834. ('Med. Gaz.' vol. 18, p. 44.) One of the witnesses in this case positively denied that the bones of the head could be fractured by the action of the uterus during parturition! It appeared highly probable that the fracture had in this instance been occasioned by the accidental fall of the child during delivery; and the prisoner was acquitted. Dr. Wharrie has published a case, also the subject of a criminal charge, in which it is probable that a fracture of the head of a child was produced by the expulsive action of the uterus. The body had been found secretly buried; it was fully developed, but the child had evidently not breathed. The navel-string had been cut and tied; six inches of it still remained attached to the body. On the left side of the cranium, near the summit, there was a small effusion of blood; and on removing this, a fissure half an inch in length was found in the edge of the left parietal bone, close to the line of the sagittal suture, and near the posterior fontanelle. On shaving off the hair there was no discolouration, nor any mark on the skin indicative of a blow. There was no evidence to show that any violence had been used to the child at its birth, and from the description of the fissure, it was a fair presumption that it had arisen from the muscular contractions of the uterus during delivery. ('Cormack's Monthly Jour.' Nov. 1845, p. 847.)

The possible occurrence of an injury of this kind has been strained in several cases of child-murder, to explain the origin of fractures which, however, could not be fairly assigned to such a cause. A case was tried at Glasgow, in April 1852 (case of *Ann Irwin*), in which Dr. Easton gave evidence. There was no doubt, from the state of the lungs, that the child had fully breathed, and there was violence to the head which satisfactorily accounted for death. The whole extent of the right side of the head was deeply ecchymosed, and there was a large quantity of coagulated blood lying between it and the cranium. In the centre of the right parietal bone there was a fracture extending across the vertex for fully four inches, and involving a part of the parietal bone on the opposite side; it was in a continuous even line, not radiated and not depressed. The pericranium, bones, and soft parts in the track of the fracture were deeply ecchymosed, while on the surface of the brain, particularly on the right side, there was a copious effusion of clotted blood. It was impossible to refer severe injuries of this kind to the action of the uterus in delivery, or to violence applied after death. The prisoner alleged that the child was still-born. (See 'Edin. Monthly Jour.' June 1825.) In the case of the *Queen* v. *Mussett* (Bury Lent Assizes, 1856), the head of a child was almost flattened from the violence sustained. It was clear that no fall or other accident could explain this condition. Some fresh blood and a single hair were found on a shelf in the cellar, for which the prisoner accounted by stating that she had there killed a rabbit. A microscopical examination, however, showed that it was human hair, and not the hair of a rabbit. (See fig. 1, p. 430, and fig. 6, p. 431.) The medical evidence established from the state of the lungs that the child had breathed, and that it had had an independent existence. The prisoner was convicted. The reader will find an elaborate medico-legal paper on fractures of the skull in new-born infants, by the late Professor Casper, in his 'Vierteljahrschrift' (1863, vol. 1, p. 1).

Length of the umbilical cord.—It has been recommended on these occasions, that we should observe the length of one or both portions of the umbilical cord, and notice whether it is cut or lacerated, as these facts may, it is presumed, throw some light on the question. But a medical witness can seldom procure the entire cord for examination, although it will generally be in his power to ascertain whether it was cut or lacerated, by examining the portion which is attached to the body of the child. The cord varies in length,—the average being from eighteen to twenty inches: but it has been met with so short as six inches ('Lancet,' June 13, 1846, p. 660), and even five inches ('Lancet,' July 11, 1846, p. 49). In a twin-case which occurred to Mr. Stedman, of Guildford, the cord was only *four inches* long. ('Lancet,' Aug. 28, 1841.) On the other hand, in one instance, where it was found twice twisted round the child's neck, it was fifty-three inches long. Dr. Churchill found, out of 391 cases, that the shortest cord was twelve inches, and the longest fifty-four inches in length. In January 1850, Dr. Tyler Smith presented to the Westminster Medical Society a cord fifty-nine inches and a half in length. In a case reported by Mr. Wood it was sixty-one inches long, and coiled twice round the abdomen of the child. ('Med. Gaz.' vol. 45, p. 263.)

As the whole of the cord can rarely be obtained, it is unnecessary to discuss the question, whether it was long enough to admit of the falling of the child without rupture. It has been remarked, that when the cord is ruptured from accidental causes during delivery, the rupture takes place either near to the placental or the umbilical end. In twenty-one of the cases observed by Klein, it was found to have been forcibly torn out of the abdomen; but it may be torn or lacerated at any part of its length, although the rupture is commonly observed near to one extremity. Among the cases of sudden delivery reported by Dr. Olshausen (page 965), the cord was torn through at three inches from the navel in one, and no bleeding followed. In two the cord was torn through its middle, and at first there was great bleeding; in three other cases it was torn close to the navel, and no bleeding had occurred. In four the cord was torn at five or six inches from the navel, and there was no bleeding, although it remained untied for ten minutes.

In *Reg.* v. *Martin* (Lewes Lent Assizes, 1860), the medical witness was asked by the judge whether rupture of the cord might not lead to fatal bleeding. The above facts show that a rupture of the cord is not necessarily fatal, even when the circumstances are unfavourable to the child by reason of the closeness of the rupture to the abdominal end. It does not appear that the examination of the cord can throw any light upon the origin of these accidental fractures of the cranium during delivery.

Effusions of blood.—In fractures of the bones of the head in new-born children, the presence of effusions of blood on the outside of the skull, or on the membranes within, is one of the most common appearances. Effusions of blood beneath the skin of the scalp are by no means uncommon in new-born children, and are not necessarily indicative of criminal violence. Each case, however, must be decided by the circumstances attending it. Effusions on the membranes and in the substance of the brain are generally the results of great violence to the head. See on this subject a paper by Dr. Elsässer (Henke's 'Zeitschrift der S. A.' 1842, vol. 2, p. 228), and another by Dr. Simon (in Horn's 'Vierteljahrschrift,' 1864, vol. 2, p. 50).

Injuries accidentally sustained in utero.—A practitioner must remember that if, while in an advanced state of pregnancy, a female should accidentally fall, the child may sustain injury by a blow through the abdominal parietes. This is not to be strained into a specious defence for violence which has obviously occurred subsequently to birth, but the fact itself is of sufficient importance to merit attention, as the following case will show:—A pregnant woman, within five days of the ordinary term of gestation, fell while running, so that her abdomen struck sharply against an angular stone. There was an immediate loss of blood, and the movements of the child ceased. Four days after the accident, parturition came on. Dr. Stanelli found the head of the child much enlarged, and in a putrid state. The woman died in an hour. On examining the child, the skull was found almost crushed, the parietal having become separated from the temporal bones as if by external violence. The marks of injury were entirely confined to the head. ('Gazette des Hôpitaux,' Nov. 7, 1846, p. 523.)

In injuries of this kind, which result from falls, it is probable that the child will be born dead; there may also be marks of violence on the abdomen of the woman. Some observers have described cases in which the limbs of the fœtus in utero have become deeply indented or spontaneously amputated, by the twisting of the umbilical cord around them. ('Dublin Hospital Gazette,' Jan. 1846, p. 153.) It is not possible, however, that these or other accidental injuries before birth could ever be mistaken for violence inflicted on the body of a child after its birth. A remarkable case of this kind has been communicated to the 'Medical Times and Gazette' (Dec. 10, 1853, p. 604) by Mr. Maclauglin, in which a child was born without limbs. It is difficult to account for the occurrence of such a singular case as this: but, practically, it could have occasioned no medico-legal difficulty had the body of the child been found dead, since the absence of the limbs could not have been referred to an act of mutilation. Dr. H. Barker of Bedford has directed attention to the subject of intra-uterine fractures, in their pathological and medico-legal relations. He advises that the bones of the body should be examined in reference to their strength, osseous development, and other physical characters. It will probably be found, as in fractures in adults from slight causes, that the bones are preternaturally brittle: in such a case, due allowance should be made for the occurrence of intra-uterine fracture, as the result of a fall during pregnancy. ('On Intra-uterine Fractures,' p. 21, 1857.)

Twisting of the neck.—Children are sometimes destroyed in the act of birth by the neck being forcibly twisted, whereby a displacement of the cervical vertebræ, with injury to the spinal marrow, may occur, and destroy life. Such injuries are immediately discovered by an examination of the body. It should be remembered that the neck of a child is very short, and that it always possesses considerable mobility.

Violence in self-delivery.—When the marks of violence found on the head, neck, or body of a child cannot be easily referred to an accidental fall, it is common to ascribe them to the efforts made by a woman in her attempts to deliver herself—the destruction of the child being an accidental result of these efforts. A medical opinion in such cases must depend upon the nature, situation, and extent of the injuries; and each must be therefore decided by the circumstances attending it. (The *Queen* v. *Horder*, Abingdon Summer Assizes, 1840; the *Queen* v. *Trilloe*, Hereford Summer Assizes, 1842; and the *Queen* v. *Turner*, Worcester Winter Assizes, 1843.) In two of these cases the children were admitted to have been born living: in the one the violence was chiefly confined to the head, and the prisoner was acquitted,—in the other the marks of violence were upon the neck, and the prisoner was convicted. These cases show the uncertainty attendant on this kind of defence. (For other instances, see the 'Brit. and For. Med. Rev.' vol. 8, p. 521.) Sanguineous tumours simulating fractures are sometimes found on the heads of new-born children (p. 946). These depend on natural causes, and must not be confounded with marks of violence wilfully inflicted. ('Med. Gaz.' vol. 36, p. 1082.) They may be known by the unruffled state of the skin. A medical witness, however, should be prepared to allow that a woman at the time of her delivery, owing to pain and anxiety, may be deprived of all judgment, and may destroy her offspring without being conscious of what she is doing. It is therefore a sound principle of law that mere appearances of violence on a child's body are not *per se* sufficient, unless there is some evidence to show that the violence was knowingly and intentionally inflicted, or the appearances are of such a kind as of themselves to indicate intentional murder. (Alison.) But, judging from cases which have hitherto occurred, it would be difficult to suggest any appearances which would be considered by a jury to indicate murderous violence.

When the skull of a new-born infant is found to be fractured, the question put to a medical witness may be,—Is the degree of injury such as to be consistent with the view that it was accidentally caused during delivery, either by the woman herself, or by some person who was present? Dr. Hicks was called by a midwife to aid the delivery of a woman. On examination he observed that the skull was fractured through the parietal bone on one side, and there was a slight fracture of the edge of the occipital bone, with a scalp-tumour. The head of the child was at the brim of the pelvis, and the fractures had been produced by the midwife in her attempts to push the head back into the cavity. This woman was delivered by instruments, and in such a case a woman would not be able to deliver herself. In another instance a new-born child had a fracture through the arch of the skull, from one side to the other, and a fracture in the frontal bone on one side. The jaw was broken, the angle of the mouth lacerated, and the arm-bone (os humeri) was also fractured. With this amount of injury it is remarkable that there was no appearance of ecchymosis externally. The woman who had been delivered of the child was charged before a magistrate with wilful murder; and the question was,—Had she, in attempts to aid delivery, produced this violence on the body by seizing the head and violently compressing it, or had the injuries resulted from the body falling on the floor of the room. Conflicting medical opinions were given, but Dr. Hicks, who was called as a skilled expert, admitted that the injuries might have been possibly inflicted by the prisoner on the child in her attempts at self-delivery.

We have elsewhere considered how far falls may produce fractures and other marks of violence on the skull of a new-born infant, but it will now be necessary to determine how far pressure on the head may produce fractures which might lead to a suspicion of murder. A woman in self-delivery can only resort to pressure. Dr. Hicks performed various experiments on the heads of still-born infants. In one instance by sudden lateral pressure he produced a fracture through the arch of the cranium, but the bones generally yielded to the force without breaking. When, however, one side of the head was laid on a hard and resisting surface like the floor, and the other side was compressed firmly and suddenly, a fracture was produced in the parietal bone to the centre although the bones of the head were firmly ossified. In two other experiments on large children with firmly ossified skulls, lateral pressure with both hands, one on each side, caused no fracture or injury such as could be mistaken for homicidal violence. There was a fissure of about half an inch in the left parietal bone, produced not so much by pressure as by an indentation of the bone. The appearances produced by pressure on the head of a still-born child, after a severe labour, were as follows:—there was a large bloody scalp-tumour over the right parietal and occipital bones; liquid blood oozed out on section; and the veins on the inside of the skull were highly congested, especially in the part beneath the scalp-tumour. The fissure produced in the parietal bone was, however, too slight to be consistent with the theory of homicidal violence. (See also a paper on this subject by Casper, 'Vierteljahrschrift,' 1863, vol. 1, p. 20.)

It follows, from these experiments on the dead bodies of new-born children, that fractures of the skull are not easily produced under the conditions in which a woman would be placed in delivering herself. The bones, as in natural delivery, yield to great pressure without breaking. Their composition and elasticity, as well as the yielding of the parts in the situation of the sutures, tend to counteract the effects of manual violence thus applied to the head.

Severe fractures with great depression of the bones, and the coexistence of lacerated wounds of the scalp with severe injuries on other parts of the body, are not consistent with the theory of their production in self-delivery. Nevertheless, as in the following case (*Reg.* v. *Sheppard*, Winchester Winter Assizes, 1863), such violence even when plainly homicidal may, under the present state of the law, be treated as accidental. The medical evidence in this case showed that the new-born child had breathed, and that there was no apparent natural cause for death. There were marks of finger-nails on the neck, evidently indicating attempted strangulation. The bones on each side of the head were crushed inwards; there was much blood effused between the dura mater and the skull, and this had caused pressure on the brain. A fall from a standing labour, or accidental force applied during delivery, could not have produced these appearances. They were caused, in the opinion of two medical witnesses, by the direct application of violence to the head of the child, and more than one blow must have been given to have produced them. In charging the jury upon the cause of death, the learned judge is reported to have said:—'The medical men had attributed it to the combined effect of strangulation and violence to the head. It might, however, be a theory that the struggles of a young woman during parturition might have occasioned the injuries, or she might in her weakness have fallen upon the child while on the floor. Did the medical evidence satisfy them beyond a reasonable doubt that this young woman had murdered her child?' The jury returned a verdict of *Not Guilty*. It is obvious from this and other cases of a imilar kind, that there is scarcely any amount of violence affecting the head of a new-born child which might not be theoretically assigned to the act of a woman in self-delivery: medical facts and opinions are generally disregarded in these cases.

Conclusions.—The conclusions to be derived from the contents of this chapter are:—

1. That a new-born child may die from violent causes of an accidental nature.
2. That some forms of violent death are not necessarily attended with external signs indicative of violence.
3. That a child may be accidentally suffocated during delivery.

4. That the usual marks of death from suffocation or drowning are not apparent, except in the bodies of children which have breathed.

5. That the state of the umbilical cord may often furnish important evidence.

6. That some females recently delivered may have strength to exert themselves and walk great distances.

7. That a new-born child may speedily die from exposure to cold or from want of food.

8. That slight fractures of the bones of the cranium may arise from the action of the uterus on the head of the child during delivery.

9. That women may be unexpectedly delivered while in an erect posture: the umbilical cord is under these circumstances sometimes ruptured, and the child may sustain injury by the fall.

10. That the violence found on the body of a child may be sometimes referred to attempts innocently made by a female to aid her delivery.

CHAPTER 76.

DEATH OF THE CHILD FROM STRANGULATION—STRANGULATION BY THE NAVEL-STRING—ACCIDENTAL MARKS RESEMBLING THOSE OF STRANGULATION—CONSTRICTION BEFORE AND AFTER DEATH—BEFORE AND AFTER RESPIRATION—BEFORE AND AFTER ENTIRE BIRTH—BEFORE AND AFTER THE SEVERANCE OF THE NAVEL-STRING—CONSTRICTION WITHOUT ECCHYMOSIS—EXAMINATION OF THE MOTHER—SUMMARY OF MEDICAL EVIDENCE—DEATH OF THE CHILD AFTER BIRTH FROM WOUNDS DURING DELIVERY.

Among the forms of violent death which are almost always attended with appearances indicative of criminal design are the following:—

7. *Strangulation.*—The destruction of a new-born child by strangulation is not an unfrequent form of child-murder: and here a medical jurist has to encounter the difficulty, that the strangulation may have been accidentally produced by the twisting of the umbilical cord round the neck during delivery. We must not hastily conclude, from the red and swollen appearance of the head and face of a child when found dead, that it has been destroyed by strangulation. There is no doubt that errors were formerly made with respect to this appearance; for Dr. Hunter observes,—'When a child's head or face looks swollen, and is very red or black, the vulgar, because hanged people look so, are apt to conclude that it must have been strangled. But those who are in the practice of midwifery know that there is nothing more common in natural births, and that the swelling and deep colour go gradually off if the child live but a few days. This appearance is particularly observable in those cases where the navel-string happens to gird the child's neck, and where its head happens to be born some time before its body.' (Op. cit. p. 27.)

Strangulation by the navel-string.—Strangulation by the navel-string can of course refer to those cases only in which it becomes firmly twisted round the neck *after* the respiratory process is established. This is rather a rare occurrence, because under these circumstances death more commonly takes place by compression of the cord, and by the consequent arrest of circulation before the act of breathing is performed. The only internal appearance met with in death from this cause is a congested state of the cerebral vessels. The presence of ecchymosis on the scalp, as well as of lividity of the face, is very common in new-born children when the labour has been tedious and difficult; and therefore, unless there were some distinct marks of pressure about the neck, with a protrusion of the tongue, such appearances would not justify any suspicion of death from strangulation.

It has been supposed, that the strangulation produced by the wilful application of any constricting force to the neck, would be known from the accidental strangulation caused by the cord, by the fact that in the former case there would be a livid or ecchymosed mark or depression on the neck. But it may be objected to this view that such a mark is not a constant accompaniment of homicidal strangulation. Severe violence to the neck may produce in the seat of constriction not only ecchymosis but a laceration of the skin, muscles, and windpipe. This, however, is far from being uniformly present. In April 1861 Dr. Evans, of Sunderland, communicated to me the particulars of the case of a new-born child which had been destroyed by strangulation. Great violence had been used, but there was no trace of discolouration in the course of the ligature, or of ecchymosis in the tissues beneath. The muscles compressed were very dark in colour. The skin had been so compressed as to give the sensation of coarse towelling of a close texture. In most cases when a ligature is applied during life the skin on each side becomes much swollen, and presents an œdematous character. This indicates an application of violence when there is still some vital power in the body of the child. The navel-string itself may be used as a means of constriction, and the mark or depression may sometimes present an appearance of ecchymosis. Among various cases which might be quoted in support of this statement, is the following, reported by Mr. Foster. In April 1846 he was summoned to attend a lady in labour with her first child. The labour was of a lingering kind, owing to the size of the head; and the child came into the world dead. The navel-string was found coiled three times round the neck, passing under the right armpit; and upon removing it, *three parallel discoloured depressions* were distinctly evident. These extended completely round the neck, and corresponded to the course taken by the coils. The child appeared as if it had been strangled. ('Med. Gaz.' vol. 37, p. 485.) Had this child been born secretly, this state of the neck might have created a strong suspicion of homicidal violence. Strangulation after birth could not, however, have been alleged, because there would have been no proof of respiration. When a blue mark is found on the neck of a child whose lungs retain their fœtal characters, it is fair to presume, *cæteris paribus*, that it has been accidentally occasioned by the twisting of the umbilical cord during delivery. Mr. Price has communicated to the same journal the account of a case in which the cord, which was short, was so tightly twisted around the neck of a child, that he was compelled to divide it before delivery could be accomplished. There was in this instance a deep groove formed on the neck, conveying the impression to himself and a medical friend that, in the absence of any knowledge of the facts, they would have been prepared to say that the child had been wilfully strangled by a rope. ('Med. Gaz.' vol. 38, p. 40.) A diagnosis might have been formed, as in the preceding case, by examining the state of the lungs. Dr. Mutter met with a case in which a child was born dead, and the cord was tightly twisted round its neck; when removed, the neck exhibited a livid circle of a finger's breadth, smooth and shining; but on cutting into this mark, no subcutaneous ecchymosis was found. ('North. Jour. Med.' Jan. 1845, p. 190.) In *Reg.* v. *Martin* (Lewes Lent Assizes, 1860), the material question was, whether a mark round the neck had been caused accidentally by the navel-string: this was denied by the medical witness. This question also arose in another important case,—*Reg.* v. *Pyne* (Gloucester Winter Assizes, 1858).

Dr. Williamson, of Leith, has directed attention to an important fact connected with the state of the lungs in a new-born child, and the medical opinions which may be expressed from their condition as furnishing evidence of live-birth. Referring to Mr. Price's case, in which the cord was tightly twisted round the neck of the child, he states that in similar cases which have occurred to himself, the child has breathed immediately on the birth of the head; but, owing to the shortness of the cord, the child would have been strangled and born dead unless he had divided it. Thus, then, a child might die apparently strangled, and not be born alive, although it might have so breathed during birth that the lungs would present all the characters of respiration. If the circumstances were not known, a medical man might be led to say that the child had been born alive, and had been destroyed by strangulation. ('Edin. Med. Jour.' Feb. 1858, p. 714.) The proof of respiration, as it has been elsewhere stated, is not a proof of live-birth (p. 920).

From these cases it will be perceived that ecchymosis in the depression furnishes no distinction between constriction produced by criminal means, and that which may result accidentally from the navel-string. In the following case ('Ann. d'Hyg.' 1841, vol. 1, p. 127), a woman charged with the murder of her child by strangulation appears to have been unjustly condemned. The child had fully and perfectly respired:—the lungs weighed one thousand grains, and, when divided, every portion floated on water, even after firm compression. There was a circular depression on the neck, which was superficially ecchymosed in some parts. From an investigation of the facts, this appeared to have been a case in which a mark on the neck was accidentally produced by the umbilical cord, during attempts at self-delivery on the part of the woman: she was nevertheless convicted and condemned to a severe punishment, chiefly from the opinion expressed by two medical witnesses, that a soft and yielding substance like the umbilical cord could *not* produce a depression and ecchymosis on the neck of a child during birth. They attributed the mark to the wilful application of a ligature like a garter; but the experiments of Dr. Négrier clearly show that the umbilical cord has sufficient strength to produce fatal constriction (loc. cit.)

In the same volume of the 'Annales d'Hygiene' (at p. 428), will be found the report of another case, suggesting many important reflections in regard to the medical jurisprudence of infanticide. In this instance the navel-string and the membranes were actually used by the female as a means of strangulation; the child had not breathed, but was thereby prevented from breathing. There was superficial ecchymosis on each side over the muscles of the neck. The defence was, that the child was born with the cord around its neck, and that it was from this circumstance accidentally strangled; but the medical evidence tended to show that the cord had been violently stretched, and employed as a means of strangulation. The child had *not breathed*, and the medical witnesses considered that it had been born dead, owing to the violence used by the woman. The cause of death here was certainly not strangulation, but arrested circulation. In the meantime, the case proves that ecchymosis (a blue mark) may be the result of violent constriction produced by the navel-string. (See the case of *Reg.* v. *Martin*, Lewes Lent Assizes, 1860; Henke's 'Zeitschrift,' 1837, vol. 4, p. 352; 'Edin. Med. and Surg. Jour.' Oct. 1838, p. 282; and Casper's 'Vierteljahrschrift,' 1859, vol. 2, p. 55.) A case occurred to Mr. M'Cann, in September 1838, in which the navel-string, which was of its full length, had been used as the means of strangulation. It was twisted once round the neck, passed under the left arm, over the shoulders, and round the neck again, forming a noose or knot, which, pressing upon the throat, must have caused strangulation, as the tongue was protruded, and there were other clear indications of the child having been strangled. The hydrostatic test applied to the lungs proved that respiration had been performed.

When the mark on the neck is deep, broad, much ecchymosed, and there is extravasation of blood beneath, with injury to the muscles or trachea, and ruffling or laceration of the skin, it is impossible to attribute these appearances to accidental pressure by the navel-string. The lividity produced by it in the cases hitherto observed has been only slight and partial, and unaccompanied by laceration of the skin, or injury to deep-seated parts. (For an instructive case by Dr. Scott, in reference to this point, see 'Edin. Med. and Surg. Jour.' vol. 26, p. 62.) On the other hand, in homicidal strangulation, much more violence being used than is necessary for destroying life, we may commonly expect to find great ecchymosis and extensive injury to the surrounding soft parts. On some occasions all difficulty is removed by the discovery of a rope, tape, or ligature, tied tightly round the neck; or, if this be not found, the proofs of some ligature having been used will be discovered in the indentations or irregularly-ecchymosed spots left on the skin—the depressed portions of skin being generally white, and the raised edges livid or œdematous.

It has been doubted whether a child can be born with the navel-string so tightly round the neck as to produce great depression of the skin and ecchymosis, *i.e.* to simulate homicidal strangulation, and at the same time perform the act of respiration fully and completely. It is important, therefore, when this hypothesis is raised in order to account for a suspicious mark on the neck, to examine closely the state of the lungs. Unless the cord be designedly put round the neck of the child *after* the head has protruded, the effect of the expulsive efforts of the uterus, when a coil has become *accidentally* twisted round the neck, would be to tighten the cord, compress the vessels, and kill the child by arresting the maternal circulation, at the same time that this pressure would effectually prevent the act of breathing. Hence the lungs usually present the appearances met with in still-born children generally; but the case which occurred to Dr. Williamson (p. 974) shows that this state of things may sometimes occur, and that a child may breathe, and die strangled by the umbilical cord before its body is entirely born. Medical witnesses, however, should not be too ready to accept such a suggestion: a careful examination of the neck will show whether a ligature has or has not been wilfully applied after birth. In *Reg.* v. *Robinson* (Lewes Summer Assizes, 1853), there was around the neck a mark of a ligature which had been *tied very tightly.* The child had fully breathed, and according to the medical evidence it had died from strangulation, owing to an accidental twisting of the cord during delivery. (*Reg.* v. *Pratley*, Oxford Summer Assizes, 1853.) In examining a suspicious mark round the neck of a new-born infant, it is proper to notice whether it does not, by its form or course, present some peculiar indentations which may render it certain that a ligature has been wilfully employed after birth. When it is found that a child has fully breathed, the presence of a deeply-ecchymosed or an œdematous mark on the neck with injury to the skin and muscles is, *cæteris paribus*, presumptive of homicidal strangulation. Death from accidental constriction of the cord during delivery should, as a general rule, leave the lungs in their fœtal condition.

Marks on the neck of a child may be accidentally produced by the navel-string without necessarily destroying the child's life. Two cases of this kind are reported by Professor Busch ('Brit. and For. Med. Rev.' vol. 10, p. 579): and a child may be destroyed without ecchymosis being a necessary consequence of the constriction produced by it. (See case by Dr. Hanff, Henke's 'Zeitschrift,' 1836, Erg. H.; also a paper by M. Tardieu, 'Ann. d'Hyg.' 1859, vol. 1, p. 149.) There is much less risk of strangulation from twisting of the cord than is commonly believed. Out of 190 cases, Dr. Churchill found the cord round the neck in fifty-two children, and the shortest cord so disposed was eighteen inches long; Dr. Négrier found it round the neck in twenty cases out of 166 natural labours. ('Ann. d'Hyg.' 1841, vol. 1, p. 137.) Insulated or detached marks of ecchymosis, as from local pressure of the fingers, cannot be set down to the twisting of the navel-string. Other accidental causes may, however, here come into operation. In *Reg.* v. *Sampson* (Bodmin Lent Assizes, 1853), it was proved that there was a mark on the neck of the child, and it was charged against the prisoner that this had been caused by pressure of the fingers, *i.e.* by pinching the windpipe. The mark was described as being of a red colour, and an inch and a quarter in length; it was suggested, in defence, that it might have been produced by the tying of a cap. The medical witness stated that it was below the spot where a cap would be generally tied, but the mark might by possibility have been occasioned by the knot of a tie. The prisoner was acquitted. In admitting this kind of defence, it is to be observed that the tying of a cap may have been the means by which death by strangulation was effected.

The *appearances* met with in the body in death from strangulation have been elsewhere fully considered (p. 674). The facts of a case communicated to me, in March 1865, by Mr. Cann of Dawlish will, however, serve to show the appearances as they may present themselves in a new-born child. A maid-servant in a family was secretly delivered of a child. When the body was found it was observed to be full-grown, and there was a piece of tape twice round the neck, which had been tied tightly in a bow. The tongue protruded between the lips; two deep furrows were found round the neck after the removal of the tape; there was great œdema with swelling of the skin between and above them, and the right hand was clenched. The lungs were of a light-red colour: they filled the chest, were highly crepitant, and floated readily on water, even when divided into sixteen pieces, and these had been submitted to strong pressure. They weighed, however, only 626 grains. The heart was healthy: the right side contained some coagula of blood—the left side was empty; the foramen ovale was open. The scalp was much congested, the congestions almost amounting to small effusions of blood; the pia mater was also congested. The inferences drawn from these facts were, that the child had been born alive and that it had died from strangulation. The lungs were as light as they usually are in the fœtal state, showing that, although they had received air, the pulmonary circulation had not been perfectly established.

Accidental marks resembling those of strangulation.—In the forepart of the neck of a child a mark or depression is sometimes accidentally produced by forcibly bending the head forwards on the chest, especially when this has been done repeatedly and recently after death, while the body is warm. It may occur, also, as an accident during labour. Such a mark must not be mistaken for the effect of homicidal violence. It has been a question whether, independently of the constriction produced by the umbilical cord, the neck of the uterus might not cause, during its contractions, an ecchymosed mark on the neck. I am not aware that there is any case reported which bears out this view; and it seems highly improbable that any such result should follow.

The discolouration may be in detached spots or patches—situated in the forepart of the neck, and evidently not arising from the employment of any ligature. These marks may depend on the forcible application of the fingers to the forepart of the neck of the child, and the indentations have been known to correspond—a fact which has at once led to a suspicion of the cause of pressure and the mode of death. At the same time it should be borne in mind that a superficial mottling of the skin occurs after death in new-born infants, in parts where moderate pressure only may have been accidentally produced. This would not be attended with ecchymosis, and its true nature would be at once determined by comparing the discoloured spots with the surrounding skin. It may be alleged, in defence, that such marks might have been accidentally produced: 1. By the forcible pressure produced by the child's head during labour, an explanation which is highly improbable, if respiration has been performed—although a child has been known to breathe in breech-presentations, while the head was still in the vagina. 2. They will be more commonly referred to a violent attempt made by a woman at self-delivery, during a paroxysm of pain. This explanation is admissible, so long as it is confined to injuries which, by any reasonable construction, might be received during labour; but supposing the marks to have been certainly produced after the complete birth of the body, it will not of course apply. The case of the *Queen* v. *Ancliffe* (Nottingham Lent Assizes, 1842) is in this respect worthy of attention; for it appears to me to show that a defence of this kind may be sometimes strained. The evidence proved that the prisoner was delivered of a child, under much suffering, on a stone floor, and in the presence of another woman—a witness. The child was born alive, and was heard to cry several times. The witness left it in charge of its mother, and on returning shortly afterwards, she found it dead with black marks upon its throat. The female midwife, who separated the child from the mother, deposed that it gave a sort of half-cry: she thought it was dead when she first saw it, and the marks on the neck were not more than a woman might have caused in attempting to deliver herself. The medical evidence proved that there were many ecchymosed marks about the throat of the child, as well as on the right side of the neck, and blood was effused beneath them. The marks might have been produced by the fingers; death had been caused by pressure on the windpipe. The judge left it to the jury to say whether the marks of violence might not have been unconsciously inflicted by the prisoner herself during labour. The jury returned a verdict of 'not guilty.' (See also a case by Bellot, 'Ann. d'Hyg.' 1832, vol. 2, p. 205.)

It is obvious from numerous acquittals that a jury are ready to act upon any suggestions, however improbable, to account for marks of violence on the neck of a new-born child. In *Reg.* v. *Ashton* (Lewes Lent Assizes, 1858), it was proved by the medical evidence that the child was found dead in the soil of a privy with a piece of riband tied tightly round the neck, the mark of a bruise on the head, two deep cuts in the throat, and about seventeen punctured wounds on the body, of which one had penetrated the heart. The medical witness stated he had no doubt the child was born alive, and that these injuries were the cause of death. The counsel for the defence suggested that there was no proof of existence after entire birth of the body, and the injuries found on the child were 'very probably the result of accident in the course of self-delivery by an unhappy young creature like the prisoner!' The jury accepted this lenient but inconsistent view of the facts, and acquitted her of the murder. In *Reg.* v. *Parkinson* (Liverpool Lent Assizes, 1859), some suspicious marks on the neck of a child were referred to the tightening of the string of a cap. The cases of *Reg.* v. *Money* (Norfolk Summer Assizes, 1858), and *Reg.* v. *Grady* (Liverpool Lent Assizes, 1858), furnish additional illustrations of the impunity with which new-born children may be destroyed by strangulation.

Among marks simulating violence, which are sometimes found on the necks of new-born children, Mr. Harvey has pointed out one of a singular kind. In February 1846 he was present at a delivery in which a child was expelled ather suddenly; and after making two or three convulsive gasps, it died. Whilst endeavouring to restore animation, he observed a bright-red mark extending completly across the upper and fore-part of the neck, from one ngle of the lower jaw to the other, as though it had been produced by strangulation with a cord, except that the mark was not continued round to the back of the neck. It was of a vivid red colour, and not like a bruise or ecchymosis: it had very much the appearance of a recent excoriation. It was most clearly defined in front, where it was about a quarter of an inch in breadth, and it became diffused at the sides. The face was not swollen, and there was no fulness of the veins. ('Med. Gaz.' vol. 39, p. 379.) A distinction in this instance might have been based upon the colour of the mark—the unabraded state of the epidermis, and the absence of congestion of the face and venous system. Nevertheless, the case is of some importance, and the facts should be borne in mind during the examination of the body of a new-born child alleged to have been strangled. Another case, which was the subject of a coroner's inquest, was published by Mr. Rose in the same journal (vol. 37, p. 530), in which red marks on each side of the nose of a new-born child were mistaken for the effects of violence applied to the nostrils during a supposed attempt at suffocation. Mr. Rose examined them closely, and considered that they were nævi (mother's marks), and had nothing to do with the death of the infant.

Constriction before or after death—before or after respiration.—A medical witness is sometimes asked on these occasions, whether he will undertake to swear that the ligature or the fingers had been applied to the neck of a child before or after its death, or before or after it had breathed. It is proper to observe that, so far as external marks of strangulation are concerned, there is no difference in the appearances, whether the constriction takes place during life, or immediately after death while the body is warm. Casper's experiments render it highly probable, that when a constricting force is applied to the neck of a dead child, at any time *within an hour* after death, the marks cannot with certainty be distinguished by any appearance from those made on a living body. ('Wochenschrift,' Jan. 1837; see also p. 677, *ante.*) With regard to the second point, it may be stated, that whether the child has breathed or not, provided it be *living* and the blood circulating, marks of violence on the neck will present precisely the same characters. The following instance is related by Casper:—The body of a new-born child was found concealed in a cellar, and the mother was charged with having murdered it. She confessed that she had heard the child cry at the birth, but that it soon died. In about *an hour* afterwards, she tied tightly round its neck a band made of a few straws, which she had hastily twisted together, in order, as she alleged, 'to prevent it from awaking.' On the fifth day the body was examined: the child was mature, well-formed, and had evidently breathed. The examiners referred death to strangulation; the woman was convicted, and sentenced to be imprisoned for life. An appeal was made against this sentence, and Casper's opinion was called for on the propriety of the medical inference of strangulation during life, from the mark found on the neck. The witnesses had stated 'that each straw in the band had produced a well-defined depression, which was whiter than the surrounding skin, while the little folds or elevations between the straws were red; and on cutting into these reddened portions, a slight effusion of blood was found beneath.' Casper gave his opinion, that this effusion (ecchymosis) might have resulted from the application of the straw-band soon after death while the body was warm; and the circumstantial evidence allowed that the ligature might have been applied at any time within an hour after death. Hence he declared that there was a want of proof that this child had died from strangulation. In consequence of this opinion the punishment was mitigated. It is impossible to deny the correctness of the inference drawn by Casper, since the mark was undoubtedly such that it might have been produced either before or recently after death, while the body was warm. Which of these two suppositions was the more probable, and whether it was more likely that a ligature should be put round a child's neck an hour *after* death to prevent it from awaking (?), or *before* death for the alleged purpose of destroying it, it was of course for a jury and not for a medical witness to decide. If there was nothing more in the prisoner's favour than her own statement as to the time when she applied the ligature, and her object in applying it, it is certain that a very humane interpretation was put on the facts. If the Court believed Casper's opinion to be correct, the woman should have been altogether acquitted, instead of having the punishment merely mitigated. It can be no crime, however absurd and unaccountable it may appear, for a person to place a ligature round the neck of a child after death, so as to produce the appearances of strangulation.

When such an extraordinary plea as this is raised, it is a fair matter of inquiry for a jury to consider the motives of human conduct, and to judge of such a defence on the principles of common-sense. If carried too far, no one who was not seen by others to perpetrate the act could be convicted of homicidal strangulation. In the case of the *Queen* v. *Wren* (tried at the Winchester Lent Assizes, 1840) the medical evidence went to show that the child had breathed, and was born alive. There was a piece of tape tied round its neck very tightly, and fastened behind, and there was a discolouration of the skin beneath; the tongue was livid and swollen, and blood was effused beneath the scalp. The medical witness admitted that the mark on the neck might have been produced after death: and as he could not therefore positively say that the child had been destroyed by strangulation, the prisoner was acquitted. (See also the *Queen* v. *Hyland*, Cent. Crim. Court, Aug. 1844.) In *Reg.* v. *Green* (C. C. C. Feb. 1860) the body of the child was found with a riband round its neck, so tightly applied that the parts around were swollen. Death was referred to strangulation, but it was suggested in the defence that the riband-ligature might have been placed there as an ornament or as part of the dress; and as the post-mortem examination of the body was not made until forty-eight hours after death, it was assumed that the tightening of the ligature was only apparent, and the result of a swelling of the parts after death! The jury acquitted the prisoner. In a similar case, tried at the Central Criminal Court in April 1865 (*Reg.* v. *Morgan*), a string such as is used for securing parcels was tied very tightly round the child's neck. The lips were swollen, the face was puffy, the tongue protruded, and there was a deep indentation round the neck in the course of the ligature. The lungs were found to be fully distended with air, so as to leave no doubt that the child had been born living, and had been destroyed by strangulation. The suggestion in the defence was, that the woman had employed the ligature for the purpose of assisting her delivery. Mr. Justice Shee, in charging the jury, said they 'must be satisfied that the child had died from strangulation, that the prisoner strangled it intending to destroy it, and that the child lived after it was entirely detached from the person of its mother, except by the umbilical cord. There was no doubt the child had died from strangulation, and that the ligature was put round its neck by the prisoner. If, however, she tied it to assist the birth, and in so doing unintentionally destroyed the life of the child, she was not guilty on the capital charge; but if she tied it with the intention of destroying it, or if she tied it after the child was fully detached (except by the umbilical cord) with that intention, then she was guilty of murder.' Dr. Lankester speaks of a case, within his own knowledge, where a child was found strangled with a stocking tied tightly round its throat. The woman who was charged with the murder was acquitted on the ground that she might have tied the stocking round the neck of the child in order to assist her in delivering herself. ('Second Annual Report,' 1865.) Such a defence is too easily admitted, and is inconsistent with the facts in many cases.

Constriction before or after entire birth.—Judging from what has occurred on several recent trials, a medical witness must prepare himself for another and a still more difficult question. Let us suppose it to be admitted, that the ligature was applied to the neck of a child while it was living, and after it had breathed; it may be inquired whether it was applied before or after the *legal* birth of the child, or, as some judges have laid down the rule, before or after an independent circulation has been established in the child's body. In the case of *Rex* v. *Enoch*, it was held 'that there must be an independent circulation in the child before it can be accounted alive.' (Archbold, p. 367.) By an 'independent circulation' we can only understand that condition in which breathing is established, and blood no longer passes from the mother to the child. Thus, this state would be proved by a cessation of pulsation in the cord, and the crying or audible respiration of the child. It will be seen that this is tantamount to insisting upon absolute proof of respiration, as evidence of life; and therefore entirely conflicts with the opinions of other judges, who have held that proof of respiration is not necessary on a charge of murder, because a child might be born alive and not breathe for some time after its birth. (*Rex* v. *Brain*, Archbold, p. 367.) On the other hand, if the presence of an independent circulation be the test of a child being legally alive at the time of the violence, the entire birth of its body is certainly not necessary for this; because, as it is well known, respiration may be established, and consequently an independent circulation acquired, before the body of the child is *entirely born.* Here, again, this judgment is opposed to the opinions of those judges who have repeatedly held that, whether a child has breathed or not, entire live-birth must be proved. One of the most common judicial objections to the hydrostatic test is, that a child may breathe, *i.e.* substantially acquire an independent circulation, but die *before its body is born.* In this state of uncertainty, it is difficult to say *what* medical evidence is required to prove. If an independent circulation alone in the child is sufficient, it cannot be always necessary to prove the entire birth of the body; but if proof of entire live-birth be sufficient, then it cannot be always necessary to show that the child had acquired an independent circulation when violence was offered to it!

In cases of tenancy by courtesy, it has been held that the quivering or spasmodic motion of a lip after birth, without respiration, independent circulation, or any other sign of vitality, was sufficient to show that a child was born alive, and that it had thereby acquired civil rights which it could transmit to others,—its heirs. Why is the proof of an independent circulation in a child to be demanded of medical witnesses in a case involving a question of its murder, when such a proof is not called for in respect to its acquisition of civil rights? If the question were fairly considered by all the judges, probably proof of an independent circulation in this sense would not be required; at any rate, it could not be consistently demanded, in the face of other decisions, that proof of respiration was not absolutely necessary to constitute live-birth in law, even in cases of child-murder. Among cases in which this question has been raised one occurred on the Oxford Spring Circuit, 1841 (the *Queen* v. *Wright*). The child was found concealed in a garden; its throat was completely cut, and there was a stab under the left arm. Gurney, B., is reported to have stopped the case, because there was no proof that the child had had 'an independent existence' when the wounds were inflicted. It is worthy of remark, that one form of murder may be the actual prevention of the establishment of an independent circulation or existence in the child, as where the navel-string is designedly tied before the commencement of the respiratory process. It has been suggested that ignorance of this point among midwives may be a cause of numerous still-births. In the meantime one fact is obvious, that whether the means of strangulation, if that be the form of murder, be applied to the neck of a living child before the entire birth of its body or afterwards,—before the establishment of an independent circulation (*i.e.* the act of respiration) or afterwards,—the appearances will be the same; and from these it will be impossible to say at which particular period the strangulation was accomplished.

Constriction before or after severance of the navel-string.—There is still another novel form which this question has taken. The witness may perhaps be asked whether the strangulation occurred before or after the navel-string was severed. It would appear that the severance of the cord has been sometimes regarded in law as a test of an independent circulation being established in the child; but this is obviously an error, depending on the want of proper information respecting the phenomena which accompany birth. Respiration, and therefore an independent circulation, may exist *before* the cord is divided; and its severance, which is never likely to take place until after entire birth, cannot consequently be considered as a boundary between a child which is really born alive, and one which is born dead. A premature severance, as it was just now stated, might positively endanger the life of a child, instead of giving it an independent existence. A healthy and vigorous child may continue to live, and breathe independently of the mother, before the division of the cord, and the time at which the severance is made depends on mere accident. Hence the marks of strangulation on the neck of a living and breathing child must be the same whether the cord be divided or not. The entire birth of the body is now considered to be complete although the navel-string is not divided. This question was raised in the case of *Reg.* v. *Morgan* (C. C. C., April 1865,—see page 979), and so decided by Mr. Justice Shee. In *Reg.* v. *Raven*, however (Warwick Lent Assizes, 1865), a different view appears to have been taken by the learned judge, Baron Martin. It was proved that the child was born alive, was placed on the bed, and cried for five or ten minutes. Fracture of the skull was the cause of death, and, according to the statement of the mother, the injury was inflicted after the child was born, but *before* the umbilical cord was severed. The learned judge directed the jury that, if they believed the injuries were inflicted at that time, and that the child died, after the cord was severed, from the injuries previously received, that would be murder or manslaughter according to the circumstances. The jury acquitted the prisoner. It remains doubtful, from this ruling, whether had the child died before the cord was severed, although it had an existence independent of its mother, the killing would have been a crime.

The following cases will illustrate the difficulties which a witness may have to encounter when it is alleged that a child has been destroyed by strangulation. In *Rex.* v. *Crutchley* (Monmouth Lent Assizes, 1837), the body of a child was discovered by a medical man (one of the witnesses) under the bed of the prisoner, who had been secretly delivered. There was a riband tied in a knot so tightly round its neck as to have prevented respiration. The child had evidently been dead some hours, and the prisoner alleged that it was born dead. On inspection, the face was found swollen and the lips were livid; the lungs contained air, and were of a florid colour; they were crepitant and floated on water, so as to leave no doubt that the child had breathed. The vessels of the brain were gorged; the other viscera were perfectly healthy. The medical witness attributed death to strangulation: he thought that the ligature had been placed round the neck before the umbilical cord, which had not been tied, was severed; but the reason for this opinion is not stated. He considered that the child had been born *wholly* alive, but admitted that the ligature would have produced the same appearance on the neck, had it been applied before the complete birth of the child. Another witness, however, stated that he thought the ligature might have been placed round the neck before the entire body of the child was born. The defence was, that the ligature had been used by the woman for the purpose of assisting herself in the labour; and the medical evidence allowed, whether this was the motive or not, that it had been applied before the child was actually born. The judge directed the jury to consider whether the prisoner wilfully killed the child; if so, whether the killing occurred before or after the entire birth of its body; and lastly, whether the killing took place while it was still attached to the body of its mother. Unless the child was destroyed after entire birth, the prisoner would be entitled to an acquittal: if destroyed while still attached to the body of its mother, the point would be reserved for the consideration of the judges. The prisoner was acquitted. There can be no doubt that, provided a child be born entirely in a living state, the destruction of it would be murder, whether the navel-string was severed or not.

In the case of the *Queen* v. *Byron* (Chester Aut. Ass. 1838), the dead body of a child was found with a rag tied round its neck, which, in the opinion of a medical witness, had caused death by strangulation; but, on being questioned by the judge, he admitted that the appearances might be explained by supposing that the prisoner had produced them in attempting to deliver herself. In the *Queen* v. *Millgate* (Central Criminal Court, Nov. 1842) a child was discovered dead, and on examination the face was livid, the tongue protruded, and the hands were clenched. On the neck was a ligature which had been passed round it four times, and was tied tightly. The vessels of the brain were congested, the lungs were partially inflated, and the general appearance of the body was healthy. The medical witness thought that the child had been born alive, and had died from the effects of the ligature on the neck. The judge directed the jury that they must be satisfied that the child was completely born at the time the ligature was placed round the neck. The prisoner was acquitted. In another case, the *Queen* v. *Webster* (Worcester Lent Ass. 1839), the following facts were deposed to by the surgeon:—The child was full-grown and was born alive; this was inferred from the lungs being completely inflated. A ligature was found on the neck,—it had been passed round twice,—was very tight, and fastened in a knot: it had caused two deep indentations. The vessels of the scalp and brain were distended with blood, but there were no marks of external violence. Death was caused by strangulation. The judge left it to the jury to say, whether they were satisfied that the child was wholly born into the world alive; and, if so, whether the prisoner had knowingly and wilfully destroyed it after it was born. The prisoner was acquitted.

Constriction without ecchymosis.—It may be an important question whether, in these instances, the absence of any mark or discolouration of the skin by a ligature should be taken as evidence of the means of constriction not having been applied during life. What we are entitled to say from observed facts is, that ecchymosis from the ligature is not a necessary consequence of constriction, either in a living or dead child: although we might expect that there would be few cases of child-murder in which, when strangulation was resorted to, there would not be some ecchymosed mark or discolouration, chiefly on the presumption that great and unnecessary force is suddenly applied. Besides, it is not improbable that a slighter force would cause ecchymosis on the skin of a new-born infant than would be required to produce such an effect on that of an adult. When there is no mark from a ligature, an attempt may be made to show that death could not have been caused by strangulation, as in the following case (the *Queen* v. *Hagg*), which was tried at the Carlisle Summer Assizes in 1841. The medical evidence was to this effect:—The deceased child was discovered with a tape tied tightly round its neck. It was full-grown and healthy, and had been born alive, as respiration had been fully established. The lungs filled the chest, floated on water, and crepitated when pressed. From the livid appearance of the face and neck, the congested state of the brain, and an effusion of blood on the surface, combined with the ligature round the neck, the witnesses were of opinion that the child had died from strangulation. On cross-examination, they said that a child may breathe when partially born. The floating of the lungs in water is of itself an uncertain test, if the body is at all decomposed. With other tests it affords a proof of a child having been born alive. One witness said the ligature had produced no mark of discolouration on the neck, while others said it was perceptible. The inference is that the mark could not have been very apparent, or there would have been no discrepancy on this point. It was ingeniously urged in the defence that the child could not have died from strangulation, because a tape tied so tightly round its neck as to cause death in this manner, would necessarily leave a discolouration of which no person could have any doubt. The prisoners were convicted. Had the defence been, as in the former cases, that there was no proof whether the ligature had been applied before or after entire birth, or the establishment of an independent existence in the child, the result might have been different. From the cross-examination it will be seen how certain stock-objections to the hydrostatic test are ingeniously made to affect medical evidence. An answer to a *general* question is rendered applicable to a *particular* case. A witness admits on a trial that the lungs may float from putrefaction or artificial inflation—in short, from any other causes than respiration. If this answer be not qualified, an impression is immediately conveyed to the Court, and not always removed by a re-examination, that some of these causes may have given rise to the floating of the lungs in this particular instance,—when, in fact, there may not have been the least trace of putrefaction, nor the least ground for suspecting that artificial inflation had been practised. As contrasts to this case, see report of a case which occurred to Mr. Coales (G. H. Rep. 1842); and another by Dr. Scott ('Ed. Med. and Surg. J.' vol. 26, p. 62).

8. *Poisoning.*—This is placed among the probable means of perpetrating child-murder, but we rarely hear of *new-born* children being thus destroyed. The earliest age at which I have known a trial to take place for the murder of a child by poison, was two months. (*Rex* v. *South*, Norf. Aut. Circ. 1834.) A quantity of arsenic was given to an infant, and it died in three hours and a quarter after the administration of the poison. At this age the case can scarcely be called one of infanticide, in a medico-legal signification, because all that it would be necessary to prove would be the cause of death; the question of life or live-birth would not require to be entered into. If, in a case of child-murder, death from poison should be suspected, it must be sought for in the usual way. Some cases have occurred, in which children have been wilfully destroyed a week or two after birth, by the administration of opium or excessive doses of purgative medicine. Oil of vitriol has been also used.

In cases in which infants are destroyed by poison, there is generally great difficulty in tracing the act of administration to the guilty person. The fluid food given to them renders the admixture of poison easy, and as many persons may have access to this food, it is often impossible to fix upon the criminal. In one instance which came to my knowledge, an illegitimate child had been placed out to nurse by its mother, a woman in good social position. It was noticed that after each visit paid by the mother the child was sick, and after repeated attacks of illness, the child died. On inspection arsenic was found in the body, and this was beyond doubt the cause of death. There was no suspicion against the nurse; but a strong suspicion fell on the mother, from the circumstances above mentioned. There was evidence, however, that the child was not at any time fed by the mother when she visited it, and that the mother had no access to the child's food. No poison could be traced to her possession, and she was not seen by the nurse, who was present, to give anything to the infant. The only fact that transpired was that, at each visit, she took it in her arms and was observed to rub its gums, and soon after her visit sickness followed. There was reason to believe that she had concealed small quantities of arsenic under her finger-nails, and that she had administered the poison while rubbing the gums of the child !

Examination of the mother.—The duties of a medical practitioner, so far as they relate to the *mother* of the child, generally the accused party, are slight. He may be required to prove, by an examination made under an order from proper authority, whether she has or has not been recently delivered of a child, and to state the probable period at which the delivery took place. (See DELIVERY, p. 761.) This examination may be necessary in order to connect her delivery with the period which may have elapsed since the birth and death of the child. Unless the examination of the woman be made within twelve or fifteen days, no satisfactory evidence can in general be obtained. It has happened, on more than one occasion, that medical men have assumed to themselves the right of enforcing an examination of a suspected woman, and, by threats or otherwise, have compelled her to undergo this. Such a course of conduct is in the highest degree indecent and improper :—if a woman willingly consents to an examination, or an order be obtained from a magistrate or other official person, the case is different. In taking this authority upon himself, a medical man is forcibly compelling an accused party to produce positive proof of her guilt—a principle which is entirely opposed to the spirit and practice of English jurisprudence. The mischievous results of such officiousness on the part of a medical practitioner are well illustrated by the case of *Weir and wife* v. *Hodgson* (Liverpool Winter Assizes, 1861). The dead body of a child had been found near the house of the plaintiff. The defendant, a surgeon, went with the inspectors of police to see Mrs. Weir ; and, having informed her that she was suspected of having had a child, told her that he had come to examine her by the authority of the law, and that she must submit. She refused at first, and proposed to send for a medical man whom she knew. In the end the defendant examined her, and there was no ground for the charge. The jury returned a verdict of £200 damages for the assault. The police can give no legal power to a medical man to make such an examination in a suspected case, and the ultimate consent of the woman, if extorted by threats or intimidation, will be no answer to a charge of assault.

Conclusions.—The following conclusions may be drawn from the preceding remarks :—

1. That congestion of the face and head in a new-born child is not a proof of death from strangulation.
2. That strangulation can only take place in children which have breathed.
3. That a child may be strangled during birth by the accidental twisting of the navel-string round its neck.
4. That the navel-string may produce a livid or ecchymosed depression on the neck, like any other ligature.
5. The marks on the neck, arising from accidental causes, may resemble those which arise from strangulation.
6. That the effect of constriction on the neck, either by the navel-string or any other ligature, is the same if the child be *living*, whether it has or has not breathed.
7. That the effect is the same whether the child has been *partially* or *entirely* born.

8. That the effect of a ligature on the neck of a *living* child is the same, whether the navel-string has or has not been severed.

9. That a new-born child may die from strangulation, without this fact being necessarily indicated by ecchymosis on the neck. This depends on the nature of the ligature, and the amount of force used.

Summary. Frequent acquittals in spite of medical evidence of criminality.—From the foregoing considerations it will be seen, that the two great points to be established by medical evidence in a case of child-murder are: 1st, that a child was *entirely born living* when the alleged violence was applied to it; and 2ndly, that its death was due *to that violence, and to no other cause whatsoever.* The leniency with which these cases are regarded by the law, and the extreme rigour with which medical evidence of *live-birth* as well as of the *cause of death* is treated, must show that they who consider that the use of the hydrostatic test can ever lead to the conviction of an innocent woman, have taken a very limited and incorrect view of the subject. The question of murder rests here, as in all other cases, upon clear and undoubted proof of the cause of death; and, more than this, it must be shown that the violence was *criminal*, and not by any reasonable construction accidental. Then it should be proved that this violence, if criminal, had been applied to the body of a child at a particular period—*i.e.* after entire birth; a case which, from what has been already stated, can rarely admit of conclusive medical proof. If strangulation, for example, be rendered probable from the facts, the woman cannot be convicted unless proof is afforded—1st, that the child was strangled after its entire body was born; and 2ndly, that she could not possibly have produced the marks of strangulation in her convulsive or half-conscious attempts at self-delivery. Medical evidence can rarely be in a condition to establish with absolute certainty either of these points, and the assumption will therefore be, as in the numerous cases already reported, in favour of the accused person. A serious question will probably here suggest itself, from the number of *impossible* medical proofs, so to term them, which the law requires in these cases, namely—How can a conviction for child-murder ever take place when there are no eyewitnesses to the crime? The answer is, that these difficulties may not be raised in the prisoner's favour; but this of course is a matter of accident. On most charges of infanticide, if the counsel for the defence insisted upon distinct medical proof of the child having been *entirely born alive* when the violence was offered to it; or that respiration, if clearly established by evidence, took place, not during labour, but after complete birth, or after the child had acquired an independent circulation—neither of these proofs could be afforded, and the case so far as medical evidence was concerned would fall to the ground. That this is not an exaggerated view of the subject, will be evident from the following case, tried at the Lancaster Lent Assizes of 1846 (*Reg.* v. *Hacking*). A female servant who had attempted to conceal her pregnancy was charged with the murder of her infant child. It was ascertained that she had been delivered of a child, and the medical evidence was to the effect that its throat had been cut with some thin-bladed sharp instrument—*a portion of the gullet and windpipe having been cut away.* The prisoner stated that the child was born dead, and confessed that she had, as she believed, cut its throat with a penknife, which she had afterwards wiped and put away. The weapon was found in her pocket. The medical witness deposed that the child had certainly *breathed*, and he was inclined to think that it had been *born alive.* He admitted that a child might breathe when partially born, and die before it was wholly born; also that the appearance of the wound, whether inflicted before or immediately after death, would be similar; and it was impossible, from the examination, to say whether the child had been partially or wholly born at the time of its infliction. The counsel for the prisoner contended that no evidence had been adduced which could satisfy the jury that the child had been *fully born alive*—a circumstance without which the charge must fall to the ground. The jury acquitted the prisoner on the charge of murder. ('Med. Gaz.' vol. 37, p. 382.) In examining this case, it may be observed that such a wound with a penknife was hardly likely to be inflicted on the child by any accident, or for the purpose of aiding delivery. As the child had breathed, it is absurd to suppose that the woman waited until it had died from some other cause, of which there was no appearance; and that after death, without any conceivable motive, she had cut out a portion of its throat. So far as the report goes, the acquittal appears to have depended on the assumption that the child was destroyed before it was wholly born; and although it had breathed, there was a want of evidence to show that this breathing had continued after its body was entirely in the world. (See also a case in the same volume, p. 1007; and 'Prov. Med. Jour.' April 2, 1851, p. 182.) In another case, *Reg.* v. *Burns* (Cent. Crim. Court, March 1863), the learned judge made the following remarks, in addressing the jury:—'Before finding the prisoner guilty, they must be satisfied that the child was completely born into the world, and had an existence independently of the mother. If they were not convinced of this, there would be an end of the inquiry, because a child not completely born could not be made the subject of an indictment for murder. Again, supposing the child to have been fully born alive, they would then have to consider whether its death resulted from any deliberate and wilful act on the part of the mother.

The frequent acquittals which take place on charges of child-murder, in spite of strong evidence of criminality, most probably depend on the fact, that there are many extenuating circumstances in a prisoner's favour: she may be young, unfortunate, friendless, and perhaps tempted by a seducer, or by utter destitution, to the perpetration of the crime. According to the present state of our law, the jury have no alternative but to convict her of a capital offence, or acquit her of the charge of murder and find her guilty of the concealment of birth, the extreme punishment for which is two years' imprisonment. This is substantially the punishment at present inflicted for the crime of child-murder in this country: for it is not to be concealed that, *medically* speaking, these technical points relative to 'live-birth,' to 'entire birth,' or to an 'independent circulation in the child,' or, lastly, 'concealed birth,' are only so many ingenious legal contrivances for evading convictions on the capital charge. Whatever doubt may exist according to the forms and principles of law, there can be no doubt, *medically*, that living children are criminally destroyed, and that the law, from the peculiar nature and stringency of the proofs required, as well as from the severity of the punishment attached in all cases to the crime, cannot reach the perpetrators. Dr. Lankester, in his Second Annual Report as Coroner (1865), states that he held inquests in sixty-nine cases of new-born children, and in fifty-six of these the coroner's juries returned verdicts of 'wilful murder.' In every instance with which he was acquainted the persons charged had been acquitted of the crime, against evidence of the most obvious and convincing kind. The fact is, he observes, 'the prosecutor, judge, and jury are all anxious to avoid a verdict which consigns to death a woman who, in nine cases out of ten, has been more sinned against than sinning.' This he remarks will probably be the case so long as the law inflicts, or threatens to inflict, death for infant-murder.

In many of these cases the punishment of death would be as much too severe, as the punishment of two years' imprisonment for 'concealed birth' is too slight; and with a full contemplation of this difficulty, the Civil Code of France (Art. 319) wisely permits the Court, on proof of extenuating circumstances, to mitigate the punishment. Some such provision is required in our law; and the unnecessary perplexities which are now thrown on medical evidence, as well as the conflicting opinions on what is live-birth and what is not, would then disappear. A change of this kind might undoubtedly be made without prejudice to the accused, or interference with the course of justice. A writer in the 'Legal Examiner' (Sept. 11, 1852, p. 555) has suggested that a special Act of Parliament should be passed to render proof of 'entire birth' unnecessary, and that there should be, at the same time, some mitigation of the punishment. A modification of this kind appears to be necessary, unless we are prepared to admit that the destruction of a living and breathing child *during* the act of birth is not a crime. It is a curious fact that while the law protects the child both before and after its birth, it allows it to be put to death with impunity during the process of birth. In addressing the Grand Jury on this subject at the Central Criminal Court, in April 1865, the Recorder observed that—'for several months past many cases of child-murder had been brought to trial. If one were to judge by the verdicts of coroners' inquests, it would appear as if the crime of the wilful murder of illegitimate children was very much upon the increase; but if one were to judge by the verdicts returned in that Court, it would appear as if it was one which never took place, because, after a long experience, he did not recollect a single instance in which a verdict of wilful murder for it had been given by the juries there. That was not the place to comment upon the law: still, it was impossible not to see that either there must be some fault in the law, or in the administration of it, there being so many charged with the capital offence, and no one being found guilty of it. There was no doubt it was a very difficult crime to establish, because there were always certain technicalities to be made clear; and in the absence of that clearness, although no moral doubt of the truth of the charge might exist, yet the verdict for the capital offence could not be returned.' This subject, in its social aspects, has been considered by Dr. Lankester in his 'Annual Reports of Coroners' Inquests for Central Middlesex,' and by Mr. Greaves, of Manchester ('Observations on Infanticide,' 1863).

It is a question which it would be here out of place to discuss, whether a verdict of manslaughter might not be proper on many of these occasions; for to say that the whole offence consists in concealing the birth of a still-born child, is virtually to disbelieve and reject the clear and satisfactory medical evidence often adduced. A verdict of manslaughter would not, however, cover those numerous cases in which it is *assumed* that the child had only lived to respire during the act of birth, and not afterwards; and yet in one case (*Reg.* v. *Tommey*, Warwick Lent Assizes, 1854), tried before Coleridge, J., in which a medical witness declined to say positively that a child was born alive and had breathed after birth, the jury convicted the prisoner of manslaughter. Respiration had been established, but it was admitted by the witness that this might have occurred during birth. There was a cut on the right side of the neck of the child, and a circular wound in the windpipe. The jury considered, notwithstanding the implied medical doubt, that the child had really come into the world alive. At the same time, they appear to have thought that the wounds on the neck were caused during attempts at self-delivery, and had not been inflicted with the intention of murdering the child.

Dr. Christison, in commenting upon the frequent acquittals on the capital charge, and convictions only on a minor offence, which cannot always be proved, attributes it to a feeling, sometimes entertained in the present day, that the killing of a new-born child, when perpetrated under the impulse of injured honour or the fear of disgrace, should not be classed with other varieties of murder. (See 'Edin. Med. and Surg. Jour.' vol. 26, p. 76.) There can, I think, be no doubt that this is the true explanation of the numerous acquittals which take place. (See case by Mr. Coales, 'Guy's Hospital Reports,' April 1842.)

It may be mentioned, in concluding this subject, as the point has given rise to a trial for malapraxis, that if injuries should be criminally inflicted on a child during birth, and the child be born alive and afterwards die from the injuries so caused, the case would be murder or manslaughter, according to the circumstances. The following instance is reported by Chitty ('Med. Jour.' p. 416; also Archbold, p. 345):—A man of the name of *Senior*, who, it appears, was an unlicensed medical practitioner, was tried, in 1832, for the manslaughter of an infant, by injuries inflicted on it at its birth. The prisoner practised midwifery, and was called to attend the prosecutrix, who was taken in labour. The evidence showed, that when the head of the child presented, the prisoner, by some mismanagement, fractured, and otherwise so injured the cranium, that it died immediately *after* it was born. It was argued, in defence, that as the child was not born (*in ventre sa mère*) at the time the wounds and injuries were inflicted, the prisoner could not be guilty of manslaughter. The judge, however, held that as the child was born *alive* and had died from the violence, the case might be one of manslaughter. This opinion was afterwards confirmed by the other judges, and the prisoner was convicted and sentenced to imprisonment. From the decision in this case, it will be seen that the law makes the question of criminality to depend upon the period at which the injuries prove *fatal*, and not upon the time at which they are inflicted on the body of a child; and had the prisoner effectually destroyed the child before it was entirely born, he would not have been guilty of any crime! The decision appears to depend on this principle of the criminal law, that the person killed must be a reasonable creature in being, and in the Queen's peace; therefore to kill a child in its mother's womb (or during birth) is no murder. (Archbold, p. 345.) The child, unless entirely born alive, does not come under the description above given; it is under these circumstances *medically* but not *legally* a *living* child. Admitting the wisdom of adopting some fixed rule of this kind in a legal view, it is undoubtedly proper that the lives of children *during the act of birth* should be protected; at any rate, that their destruction should not be treated, as it now appears to be, with perfect impunity.

If a child be born alive, as a result of criminal abortion, and die, not from any violence applied to its body, but as an effect of its being immature, this will be sufficient to render the party causing the abortion indictable for murder.

RAPE.

CHAPTER 77.

NATURE OF THE CRIME—SOURCES OF MEDICAL EVIDENCE—RAPE ON INFANTS AND CHILDREN—LEGAL COMPLETION—PROOFS OF PENETRATION—MARKS OF VIOLENCE—RUPTURE AND LACERATION—PURULENT DISCHARGES FROM THE VAGINA—EVIDENCE FROM GONORRHŒA AND SYPHILIS—RAPE ON GIRLS AFTER PUBERTY—DEFLORATION—SIGNS OF VIRGINITY—PROOFS OF INTERCOURSE.

Nature of the crime. Sources of medical evidence.—Rape is defined in law to be the carnal knowledge of a woman by force, and against her will. In ancient times it was punished by castration,—a punishment which, according to Dr. Griffiths, is retained in Virginia and Missouri, when the crime is perpetrated by a coloured man on a white woman, but not *vice versâ*. The Roman law, on which our ancient law was founded, was to this effect—'Rapta raptoris aut mortem aut indotatas nuptias optet,' upon which there arose what was thought to be a doubtful case: 'Unâ nocte quidam duas rapuit: altera mortem optat, altera nuptias!' For a long period it was punished as a capital crime in this country, but transportation for life was substituted for this punishment by 4 and 5 Vict. c. 56, s. 3. Since this change was made in the law, it has been alleged that the crime has undergone a considerable increase. On the average of four years, rapes increased 57 per cent. ('Law Times,' 4th Jan. 1845); and it was stated officially in Parliament, in 1847-8, that the increase had actually amounted to 90 per cent. since the abolition of capital punishment!

Medical evidence is commonly required to support a charge of rape, but it is seldom more than corroborative; the facts are, in general, sufficiently apparent from the statement of the prosecutrix. There is, however, one case n which medical evidence is of some importance,—namely, when a false accusation is made. In some instances, as in respect to rape on infants and children, the charge may be founded on mistake; but in others there is little doubt that it is often wilfully and designedly made, for motives into which it s here unnecessary to enquire. The late Professor Amos remarked, that for one real rape tried on the Circuits, there were on the average twelve pretended cases! In some few instances these false charges are at once set aside by medical evidence—in others, medical men may be sometimes the dupes of designing persons; but in the majority, the falsehood of the charge is proved by inconsistencies in the statement of the prosecutrix herself. I am informed hat in Scotland, where there is a public prosecutor and a careful preliminary nquiry, false charges of rape are exceedingly rare. The *consent* of the girl does not excuse or alter the nature of the crime when she is under ten years f age, since consent at this period of life is invalid; and the carnal knowledge f such a girl is rape in law, and is made a felony by the 24 & 25 Vict. . 100, s. 50. Even the solicitation of the act on the part of the child does ot excuse it.

The duty of a medical witness on these occasions is very simple; and perhaps this will be best understood by considering the subject in relation to females at different ages. On being called to examine a person on whom a rape is alleged to have been committed, the first circumstance which a practitioner should notice is the precise *time* and date at which he is summoned,—taking an early opportunity of comparing his watch with some neighbouring clock. This may appear a trivial matter, and one wholly irrelevant to the duties of a medical practitioner; but it is to be observed, that the time at which a surgeon is required to examine a prosecutrix may form a material part of the subsequent inquiry. It will be highly important to the defence of a person accused, if it can be proved that the female did not take the earliest opportunity to complain; and it may be also the means of defeating an alibi falsely set up by an accused person in his defence.

Casper states, from his experience, that rapes on children are by far the most frequent. Out of 111 cases which he had been called on to examine up to 1856, the ages of the females upon whom the crime was perpetrated were, respectively — from $2\frac{1}{2}$ to 12 years, 78: from 12 to 14 years, 17: from 15 to 18 years, 7: from 19 to 25 years, 7: at 47 years, 1: and at 68 years, 1. Hence it follows, from this series of cases, that above 70 per cent. of all rapes are perpetrated on girls below the age of 12 years. ('Gerichtlich. Med.' vol. 2, p. 130.) It is rare that cases of rape are tried without medical evidence; occasionally an attempt is made to dispense with it, and the result is generally an acquittal. Juries naturally dislike to convict persons of this serious crime, unless the statement of the prosecutrix is corroborated by medical facts and opinions. (*Reg.* v. *Walker*, Maidstone Winter Assizes, Dec. 1862.) Medical evidence in cases of rape may be derived from four sources:—1. Marks of violence about the genitals. 2. Marks of violence on the person of the prosecutrix or prisoner. 3. The presence of stains of the spermatic fluid or of blood, on the clothes of the prosecutrix or prisoner. 4. The existence of gonorrhœa or syphilis in one or both. This evidence will vary according to the following circumstances:—

RAPE ON INFANTS AND CHILDREN.

The sexual organs should in these cases present marks of injury if the crime has been completed, and there has been *any resistance on the part of the child*: for it is impossible to conceive that forcible intercourse should take place without the production of ecchymosis, the effusion of blood, or a laceration of the pudendum. Even without reference to manual violence on the part of the assailant, if an adult, the size of the male organ must necessarily cause much local injury in the attempt to enter the vagina of a child. If the violation has taken place within two or three days, the appearance presented by the parts may be as follows:—1. Inflammation, with more or less abrasion of the lining-membrane. 2. A muco-purulent discharge from the vagina, of a ropy consistency and of a yellowish or greenish-yellow colour, staining and stiffening the linen worn by the girl; the mucous membrane of the urethra is inflamed, rendering the discharge of urine painful. 3. In recent cases blood may be oozing from the abraded membrane, or clots of blood may be found deposited in the vulva. 4. The hymen may be entirely destroyed, or (what is more commonly observed) it may present on careful examination one or more slight cuts or lacerations. Owing to the inflamed state of the parts, the proper examination of the hymen is rendered difficult—any attempt to separate the thighs for this purpose causing great pain. For this reason, also, the child walks with difficulty and complains of pain in walking. 5. Lastly, the vagina may be unnaturally dilated.

It has been propounded as a serious question, whether a rape can be perpetrated on children of tender age by an adult man; and medical witnesses at trials have adopted conflicting opinions. Some are inclined to regard all such charges as unfounded, and to seek for other medical explanations of the symptoms above described. This practice has been carried of late years to an undue extent, simply because many of these charges have been proved to be false: but common experience, supported as it is by the accurate observations of Casper (p. 990), show that there is too frequently a real foundation for the charge in reference to children, and that a girl is not to be discredited merely because of her tender age. This would be conferring impunity on the acts of a vile class of offenders. In all cases there should be good medical evidence and a corroboration from circumstances.

For the *legal* establishment of the crime, proof of penetration only is demanded (24 & 25 Vict. c. 100, s. 63). In a case of old date, *Rex* v. *Russen*, it was held that a degree of penetration so slight as not to injure the hymen would be sufficient in law for the completion of the crime. In the case alluded to, the hymen of the child was proved to be entire, and, under the direction of the judge, the prisoner was convicted and executed. This trial took place in 1777; but Gurney, B., subsequently held that there must be a sufficient penetration of the male organ to rupture the hymen; and, unless this membrane was found ruptured, the crime would not be complete in law. (*Rex.* v. *Gammon*, Archbold, 'Crim. Plea.' p. 407.) This decision was afterwards overruled by the judges, in a case reserved for their consideration by Coleridge, J., and reported in 9 Carrington and Payne. (See also *Reg.* v. *Lines*, 1 Carrington and Kirwan's 'Reports.') It is now, therefore, an admitted principle, that a sufficient degree of penetration to constitute rape in law may take place without necessarily rupturing the hymen; but there must be medical evidence to show that, in a special case, there was actual penetration—the degree of penetration being quite immaterial. It is true that there could not be a complete introduction of the adult male organ into the vagina of a child without a rupture or laceration of the soft parts; but the absence of such marks of violence would not justify a medical witness in denying the perpetration of the crime, since the law does not require proof either of a complete or of a violent introduction. Penetration to the vulva is sufficient to constitute the crime.

In a case brought before a London magistrate a few years since, the evidence left no doubt that the crime had been committed on the person of a girl about ten years old. The surgeon stated that there were considerable marks of violence about the pudendum, but completion (*i.e.* complete penetration) was, in his opinion, physically impossible on a child under ten years of age. Upon this evidence the charge of felony was abandoned. In the following case the child was older, but the facts bear immediately upon the question which we are here discussing. It was tried at the Central Criminal Court in March 1843; and the particulars were communicated to the profession by Mr. Adams. ('Lancet,' March 25, 1843.) A man was charged with a rape upon his own child, a girl fourteen years of age. Mr. Adams examined the child about two days after the alleged rape, when he found no injury about the vulva or adjacent parts and the hymen was unruptured. He gave a positive opinion at the trial that no rape had been committed; but two other medical witnesses, men of experience and integrity, stated their belief that the crime had been perpetrated. It appears that they had examined the child soon after the alleged offence, and a day or two before Mr. Adams. The prisoner was acquitted of the rape, but found guilty of the assault. The absence of any marks of injury about the vulva so short a time after the alleged criminal act, and the fact of the hymen being unruptured, in some measure justified the opinion of Mr. Adams, that there was no medical proof of a rape having been committed: at the same time he candidly restricted his opinion, by saying, that if by rape we are to understand penetration to the vulva, then was it effected; but there was no evidence to show vaginal penetration—on the contrary, the unruptured state of the hymen in an alleged forcible intercourse was against this view. The only remark which this case requires is, that the Statute Law says nothing about the rupture of the hymen as a necessary part of the evidence: it merely requires from the medical witness proof of penetration; this may occur, and the hymen remain intact. The distinction here drawn by the witness has no real existence. From the decisions of our judges, vulval penetration, whether with or without violence, is as much a rape as vaginal penetration.

In Scotland this question came formally before the judges in the case of *Macrae* (High Court of Justiciary, 1841). It was insisted by the prisoner's counsel, that there should be proof of full and complete penetration; and there was no sufficient evidence to show that penetration had taken place into the canal of the vagina beyond the vulva. Lord Meadowbank charged the jury to the effect, that the evidence of the prisoner's guilt was complete; that scientific and anatomical distinctions as to where the vagina commenced, were worthless in a charge of rape; and that by the law of Scotland it was enough if the woman's body was entered. In a case like this, where there was no evidence of emission, and the girl was young, he did not consider it necessary to show to what extent penetration of the parts had taken place,—or to prove that it had gone either past the hymen, into what was anatomically called the hymen, or even so far only as to touch the hymen. The prisoner was convicted. ('Cormack's Edin. Jour.' January 1846, p. 48.) I am informed that, up to the date of the case of *Macrae*, it had been the practice with the Scotch judges to require proof of *full* and *complete* penetration. See on this question a paper by Dr. Easton ('Glasgow Med. Jour.' July 1859, p. 129).

Marks of violence.—When, as in the case above related, there are no marks of violence or physical injury about the pudendum of a child, whether because none originally existed, or they existed and had disappeared in the course of time, a medical witness must leave the proof of rape to others. He can only answer questions of possibility or probability, according to the special facts proved. It is, however, in all cases his duty to be guarded in giving an opinion that a rape has been perpetrated, when there is a total absence of marks of violence on the genitals. It is true that rape in a legal sense may be perpetrated without necessarily producing such marks on a child, but then the proof of the crime will not depend on *medical evidence* only. The absence of marks of violence on the genitals, when an early examination has been made, furnishes a strong presumption that rape has *not* been committed on these young persons. It is obvious that a false charge might be easily made and sustained, if medical opinions were hastily given on the statements of a mother and child, when there was no physical appearance to corroborate the accusation. See on this subject a paper by M. Toulmouche, 'Ann. d'Hyg.' October 1(8, p. 338.)

On the other hand, if marks of mechanical violence are present, they must not always be hastily assumed as furnishing proofs of rape; for cases are recorded in which such injuries have been purposely produced on young children, as a foundation for false charges against persons with a view of extorting money. The proof or disproof of facts of this kind must rest more upon general than on medical evidence, unless the injuries obviously indicate the use of some weapon or instrument. It should be remembered that the hymen is not always present in young children: it may be, according to some, congenitally deficient, or, what is more probable, it may have been destroyed by ulceration or suppurative inflammation of the parts,—a disease to which female infants of a scrofulous habit are very subject. The mere absence of this membrane, therefore, can afford no proof of the perpetration of the crime, unless we find traces of its having been recently torn by violence.

Other and more important deductions may, however, be drawn from the presence of severe injuries on the genitals, *i.e.* of rupture, or laceration of the vagina or perinæum. It is difficult to obtain accurate medical reports of these cases as they occur in England: but it is quite clear that the male organ may produce much physical injury whether the child does or does not resist the attempt. (Casper's 'Vierteljahrschrift,' April 1863, p. 337.) Dr. Chevers, in referring to Indian experience, says that in a large proportion of rapes on children, it was very clearly proved that rather severe injuries had been inflicted on them. In the 'Nizamut Adawlut Reports' (1853–5), there are several instances recorded in which the vagina was lacerated. Out of 66 trials for rape, there were 25 convictions: and in one-half of these, the females were under the age of *twelve* years. In one case of a girl, æt. 12, there was a rupture of the lower part of the vagina to the extent of half an inch. In another, a child of six, but apparently much younger, had suffered, as a result of rape, from rupture of the hymen and laceration of the perinæum and vagina. In one instance the violence proved fatal, but the medical particulars were not given ('Med. Jur. for India,' p. 468.) I have already observed that injuries have been sometimes intentionally produced on the genitals of infants and children by mechanical means, with a view of extorting money in laying false charges of rape. Dr. Chevers, from whose work I have quoted the above facts, states, on the authority of a missionary well acquainted with the habits of the natives of Calcutta, that mechanical means are commonly employed, even by the parents of immature girls, to render them *aptæ viris*, especially by the use of the fruit of the plantain. In one instance, a man was convicted of rape who, according to the evidence, had previously used a small stick—*ad deobstruendam viam.* This led to effusion of blood, but to no permanent injury. It is scarcely credible that mothers should resort to such practices, nevertheless the facts are too well accredited to admit of denial. Casper officially examined a girl only ten years of age, whose vagina had been dilated by the mother, at first with two fingers, afterwards with four, and finally by means of a long stone introduced into it, in order to fit her for intercourse with men! The hymen was not destroyed, but there were lacerations in it; the mucous membrane was reddened and painful to the touch, and there was a mucous discharge from it. ('Gerichtliche Medicin,' vol. 2, p. 162.) If this child, tutored by its mother, had been taken before a surgeon for examination, on the allegation that some man had committed a rape upon her, an opinion confirmatory of the charge might have been given. A fact like this proves that medical evidence can do no more than show that a girl with such appearances about her sexual organs has suffered from some mechanical violence applied to the part, but whether by the human member, or any other physical means, it would be impossible to say. The only chance of getting at the truth in such cases is by a rigorous cross-examination of the mother and child in the absence of each other.

In April 1840 Dr. Brady communicated to the Dublin Association of Physicians a case of alleged rape on a female infant only eleven months old, in which the violence done to the genitals proved fatal. During the march of a regiment to Templemore, the prisoner *Hume*, a soldier, who was with the sick car, took the child from its mother (Mary Hall) to carry it some way for her. The child was quite well when he took it: he walked on quickly, and was out of the mother's sight in half an hour. When she came up, he had the child standing on the grass facing him, and he was bent over it: with one hand he held the child's petticoats up, and his other was covered with blood. He told the mother that the child was ill and passing blood. The mother rolled it in her shawl, and carried it until she reached Templemore, when she went to an apothecary; but no examination was then made, and it was not until the next morning that in washing the child the marks of violence were seen. This was the substance of the mother's evidence, which was uncontradicted at the trial. A surgeon examined the child twenty hours after the alleged outrage: it was then in a state of complete collapse, and it died in a few hours. On examination all the external parts of generation were found in a torn state, and violently inflamed; the perinæum was torn nearly through; the nymphæ, the mucous lining of the labia and clitoris were likewise lacerated, so that the whole presented the appearance of a large lacerated wound in a high state of inflammation. After death, besides the above-mentioned appearances, the vagina was found greatly dilated and torn from its attachment to the neck of the uterus posteriorly, making a large opening into the cavity of the abdomen, in which a quantity of bloody serum was effused. ('Med. Gaz.' vol. 26, p. 160.) Sir W. Wilde of Dublin, on making inquiry into the particulars of this case, ascertained that there was no proof of the actual perpetration of rape. The severe injuries to the genital organs which led to death were produced, it is alleged, by the fingers,—the man being at the time partially intoxicated. ('Dub. Quart. Jour. of Medical Science,' Feb. 1859.) This can scarcely be regarded as exculpatory: for if a female child is destroyed by violence to the genital organs, it can create no difference, on a charge of manslaughter, whether the injuries were produced by the fingers or by the male organ.

In January 1858 a girl seven years old was brought into Guy's Hospital, owing to injuries resulting from a perpetration of rape by a boy under seventeen years of age. About half an hour had elapsed; she was then examined by Mr. Hicks, the house-surgeon, and he found that there was a complete destruction of the hymen, with a laceration of about one-eighth of an inch extending into the perinæum. There had been profuse bleeding, as the clothes were saturated with blood. There was then no complaint of pain, and there were no scratches or marks of violence on any part of the body. There was no discharge of a purulent kind. The child was of a scrofulous habit: but she was not suffering from vaginitis, and appeared in other respects perfectly healthy. I saw the girl with Mr. Hicks about forty-eight hours after the occurrence; the bleeding had then ceased, and the extent of the lacerations was very perceptible. There was no discharge of any kind from the vagina, and no inflamed or swollen condition of the parts. The boy was examined by Mr. Hicks about an hour after the perpetration of the rape, and although he had been under strict custody, and had had no opportunity of changing his clothes, there was *no blood* found about his private parts, or on his clothing. It is probable, as the boy was interrupted in the act by the screaming of the girl, that he suddenly withdrew after having caused the laceration, and that the bleeding was an after effect of oozing from the ruptured vessels. This is an important fact, because, had not the circumstances been known, the absence of blood on his person might have been construed into a strong proof of innocence. Dr. Sawyer met with a case in which a rape was committed on a girl æt. 5. There was a bruised and swollen state of the genitals; the hymen was not ruptured, and there was no laceration of parts. In spite of this a large amount of blood had been lost. This bleeding, he considers, took place from the hymen, which was in a highly congested state. The man who had perpetrated the crime was examined soon afterwards, but no appearance of blood was found on his organs; there were a few stains only on the front of his clothing. ('New Orleans Med. Gaz.' 1858, p. 283.) A case occurred to Mr. Sells, of Guildford, in 1863, in which he found on examining the person of a girl said to have been violated, laceration of the hymen, a clot of blood recently effused lying on the vulva, and the thighs of the child smeared with blood, quite fresh; there was also blood on the sheets of the child's bed. The next morning he examined the accused, but he could find no trace of blood upon him or on the clothing which he wore at the time of the alleged assault. In this case, as there was a failure of identity, the accused was discharged.

Sometimes, owing to the violence used, the parts are lacerated; and inflammation, followed by sloughing or mortification, may set in and destroy life, especially in children of an unhealthy habit. Care should be taken that the symptoms of a malignant form of disease (noma), to which female children are sometimes subject, are not mistaken for criminal violence. The case of *Amos Greenwood* (Liverpool Winter Assizes, 1857) is of some interest in this respect. The prisoner was convicted of the manslaughter of a female child under ten years of age, as the result of injuries produced by a criminal assault. The main facts against the prisoner were considered by the Court and Jury to be clearly proved: he was convicted, and sentenced to penal servitude for life. The propriety of this conviction has been strongly questioned by Sir W. Wilde in a paper published in the 'Dublin Quarterly Journal' of February 1859. It would be impossible in this place to give an analysis of the conflicting statements and counterstatements which have been made respecting Greenwood's case; but there is no reason to doubt that the prisoner was accessory to the death of the child. A distinguished member of the Northern Circuit, who took no part in the case, but was present and heard the whole of the evidence, informed me that it was satisfactorily proved that violence had been done to the genital organs, and in the general opinion of the bar the man was rightly convicted. The reader will find the evidence fully discussed in the 'Medical Times and Gazette' for 1859, April 9, p. 361; April 23, p. 417; April 30, p. 442; May 21, p. 518; May 28, p. 544; June 18, p. 638; and July 2, p. 21.

Mr. Colles has reported a case in which a rape was committed by an adult on a child eight years old; it terminated fatally from peritonitis, as a result of the violence, six days after the assault. The child stated that the accused had had forcible connection with her, causing much pain and loss of blood. There were no marks of violence (bruises?) externally, but the orifice of the vagina was lacerated in its entire circumference, and the perinæum was nearly torn through. It was found, on inspection, that the orifice, as well as the whole of the vagina, was in a state of gangrene, and that its posterior wall had been lacerated at its line of junction with the uterus to the extent of an inch. There was no ulceration; the labia and clitoris had not undergone any change. ('Med. Times and Gaz.' June 2, 1860, p. 560.) The prisoner subsequently confessed his guilt. A case was communicated by Dr. M'Kinlay to the 'Glasgow Medical Journal' (July 1859, p. 140), which proves that extensive injuries may be produced on a child by the act of violation. The girl in this instance was about six years of age, and very intelligent. From her description of the assault, it appears that she fainted, probably owing to the severity of the pain. When examined, it was found that the vagina was ruptured in various directions. One laceration extended from the lower part downwards, dividing the recto-vaginal septum and perinæum down to the verge of the anus. There was a lacerated opening in the coats of the rectum; the orifice of the vagina was lacerated upwards as well as laterally; the parts were raw, swollen, and very tender. When the child was first seen, there was blood on the limbs and clothes: she recovered from these serious injuries in about two months. In reference to the case of Amos Greenwood (*supra*), it was a question raised in favour of the prisoner, whether rupture of the perinæum could or could not be effected in rape on a girl. Some eminent members of the profession appear to have doubted the possibility of rupture being produced under these circumstances (see Sir W. Wilde's paper, 'Dub. Med. Journal,' February 1859); but the facts here recorded show that this opinion is erroneous.

In a case which occurred to Dr. Bullen, a girl aged seventeen was violated by several men in succession: she then became insensible, and was unable to state how often the act had been perpetrated. When examined the next day, the genitals were bloody, inflamed, and painful; the hymen was ruptured, the fourchette torn, and the labia and perinæum presented a dusky appearance of inflammation. In spite of treatment, ulceration followed, and the clitoris, nymphæ, perinæum, labia, and mons veneris sloughed away, leaving the pubis exposed. After a long illness the ulcer healed, and she left the infirmary. At no period were there symptoms of syphilis. Such a state of the parts, obviously a result of violence, might have been erroneously ascribed to *noma* or malignant ulceration or mortification of the genitals, as it is observed in some eruptive fevers. ('Dub. Med. Press,' March 1840; Beck's 'Med. Jur.' vol. 1, p. 160.)

Purulent discharges from the vagina. Vaginitis. Infantile leucorrhœa.—The existence of a purulent discharge from the vagina, as a result of vaginitis or inflammation of the vagina, has been erroneously adduced as a sign of rape in young children. The parents, or other ignorant persons who examine the child, often look upon this as a positive proof of impure intercourse; and perhaps lay a charge against an innocent person, who may have been observed to take particular notice of the child. Some cases are reported, by which it would appear that men have thus narrowly escaped conviction for a crime which had really not been perpetrated. Dr. Percival, in his 'Medical Ethics' (3rd ed. 1849, p. 117), has related a case which has been the subject of frequent quotation and comment in reference to false charges of rape. A girl æt. 4 was admitted into the Manchester Infirmary in February 1791, on account of a mortification of the female organs and general depression of strength. She had been in bed with a boy fourteen years old, and there was reason to suspect that he had taken criminal liberties with her. The mortification increased, and the child died. The boy was tried on a charge of rape at the Lancaster Assizes, but acquitted on evidence being adduced that several instances of a similar disease had appeared among girls about the same period of time, in which there was no reason to suspect injury or guilt. In one of these cases there was typhus-fever with a mortification of the genitals. There was no cause of death discoverable on inspection: the lumbar glands were of a dark colour, but all the viscera were sound. This case, with the whole of Mr. Kinder Wood's paper on the subject, has been republished by Mr. Kesteven. ('Med. Times and Gaz.' 1859, April 23 and 30.)

A purulent discharge with aphthous ulceration is occasionally a result of vaginitis (inflammation of the vagina) in young children. It may arise from dentition, or local causes of irritation—as worms or uncleanly habits,—and is observed especially in children of a scrofulous habit. It is frequently met with in girls up to six or seven years of age: and children thus affected have been tutored to lay imputations against innocent persons for the purpose of extorting money. This state may commonly be distinguished from the effects of violence, either by the hymen being entire—or by the non-dilatation or laceration of the vagina or perinæum—by the red and inflammatory condition of the mucous membrane,—and the abundance of the purulent discharge, which is commonly much greater than that which takes place as a mere result of violence. Capuron mentions two cases, in which charges of rape on children were falsely made against innocent persons, on account of the existence of a purulent discharge the nature of which had been mistaken. ('Méd. Lég. des Accouchemens,' p. 41.) Sir Charles Locock observes that the purulent discharges of female children are attended with redness and swelling of the sexual organs, and are sometimes accompanied with excoriation and sloughing of the skin, owing to the irritating nature of the matter. They are so connected with dentition, that they not only appear with the first and second set of teeth, but even when the wisdom-teeth are irritating the system at a mature age. Mr. South, commenting on this statement ('Chelius's Surgery,' vol. 1, p. 161), justly remarks that a knowledge of these facts 'is highly necessary, and is very properly insisted on, as there is no doubt that many men have suffered capital punishment from the ignorance of practitioners on this point; and even now, with our better knowledge, it is by no means unfrequent to hear of medical men giving a decided opinion which is almost certainly erroneous upon the gonorrhœal character of pudendal discharges, and thus jeopardising the character if not the life of an innocent man. On all occasions of giving opinion or evidence in such cases, a practitioner is bound to speak with extreme caution, and only on the most incontestable proof (which by a mere examination of parts it is almost impossible for him to attain), before he makes a positive statement as to the gonorrhœal character of the discharge.'

A gonorrhœal discharge is generally very profuse—much more profuse than that purulent discharge which is simply the result of such violence as is produced in the commission of rape. There is another fact worthy of notice, namely, that the last-mentioned discharge besides being less profuse lasts for a much shorter time. Casper has recommended that in doubtful cases another examination of the sexual organs should be made in ten or twelve days. If the purulent discharge has then ceased, or is ceasing, there is good reason to believe that it was not the result of gonorrhœa, but of some temporary cause of inflammation in the mucous membrane. ('Klinische Novellen,' 1863, p. 10.) Of false charges of this description he furnishes various instances (p. 19).

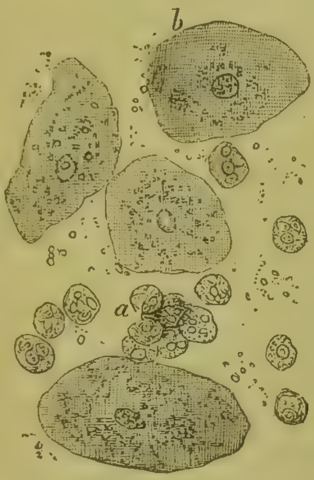
Assuming that the surgeon is satisfied, from a careful examination, that the purulent discharge must have existed before the alleged assault, and that it is of the ordinary inflammatory character with which young girls are liable to be attacked, this would not justify him in affirming that no rape had been attempted or perpetrated on the child. Girls labouring under this disease may be the subjects of rape, and it will then be necessary to seek for further evidence on the condition of the hymen, the lining-membrane of the vagina, and the vulva. If nothing is found beyond what is consistent with disease, there is an absence of medical evidence to prove that any rape has been committed. An aphthous state of the membrane of the vagina must not, under these circumstances, be ascribed to injury caused by mechanical violence. (Casper's 'Gerichtliche Medicin,' vol. 2, p. 148.)

This subject long since attracted the attention of Mr. Kinder Wood, Sir Astley Cooper, Mr. Lawrence, and other medical men: but there is still much popular ignorance in reference to it, and false charges of rape on children are now not unfrequently made. Mr. Kesteven met with a case in which a discharge from the vagina of a child nine years of age was considered by the parents to indicate that intercourse had been had with her. There was no mark of contusion or violence on or about the pudendum or in the vagina, and the case was very properly pronounced to be one of vaginitis. ('Med. Gaz.' vol. 47, p. 372.) A similar case was referred to me in which a soldier was supposed to have infected a child: but an investigation showed that it was a purulent discharge depending on inflammation of the vagina. In another, which was the subject of a trial at the Somerset Autumn Assizes of 1857 (*Reg.* v. *Hodges*), there is reason to believe that the accused was improperly convicted of a criminal assault on a child when the appearances were really due to the existence of vaginitis from natural causes. (See report of the trial by Dr. J. Wybrants, of Shepton Mallet, 1861; also a letter by Mr. Hudson, 'Med. Times and Gaz.' April 13, 1861, p. 403.) Charges of rape are sometimes rashly made in these cases, either in the absence or in actual defiance of a medical opinion. Mr. Hamilton has reported an instance of this kind in a child æt. 7. ('Dub. Med. Press,' May 4, 1853, p. 276.) There was an inflammatory state of the vagina, and a yellowish discharge issued from it; but there was no sign of rupture, contusion, or any mark of violence. The medical opinion was to the effect that there was nothing to show that any violence had been used to the child, or that she had been infected with the venereal disease. Nevertheless, the accused was placed on his trial; but the evidence of the child broke down, and the man was acquitted. In the same paper, Mr. Hamilton relates a case in which syphilis was communicated to a girl æt. 6 by a boy aged 19. In this case the accused was found to have numerous chancres around the orifice of the prepuce, and on examining the little girl, there were chancrous excoriations on the inside of the labia. Other syphilitic symptoms manifested themselves. The prisoner was convicted.

The subject of infantile leucorrhœa has been fully investigated by Sir W. Wilde, of Dublin. ('Medico-legal Observations,' &c., 1853.) This gentleman has collected numerous instances illustrating in a remarkable manner the great danger to which innocent persons are exposed by reason of false charges of rape on children. Two of these are especially noticed in his essay. A charge was raised against a respectable man, that he had had intercourse with, and produced disease in, two children. The day and hour were circumstantially given, extorted as it appears from the children by the parent, and the man was put upon his trial. The appearances were such as are usual in these cases,—a purulent discharge from the vagina with some excoriation, but no bruise, laceration, or mark of violence on the pudendum. There had not been any penetration of the vagina. The charge against the prisoner, although unsupported by any affirmative circumstances, received some strength from the admission made by one medical witness for the prosecution,—namely, that the appearances *might* have been the result of violence, and that the discharge *might* have been produced by friction with the member of a healthy man. (Wilde, op. cit. p. 14.) It was proved that the prisoner was not affected either with gonorrhœa or syphilis. Drs. Geoghegan, Churchill, and other medical witnesses of repute, gave testimony to the effect that the child was labouring under an ordinary form of disease, and that there was no medical indication that it had been subjected to any kind of violence. This testimony was not considered by the Court to furnish a complete answer to the charge, since it was inferred that the appearances on the child *might* have been caused by the accused, without any marks of violence being left on the pudendum! So strong was this feeling, that, had the case rested here, it is probable the accused would have been convicted upon the unsupported statement of the child. An alibi was, however, clearly proved, and the man was acquitted. In this instance, it will be perceived it was alleged that a man who laboured under no disease had caused a purulent discharge in a child! At the same time, it was admitted that the pudendum had sustained no violence whatever. Medically speaking, there appears to have been not the slightest pretence for charging the accused with the perpetration of rape; the appearances might have or might *not* have been caused in the manner suggested. Under such loose medical evidence as this no person would be safe. An acquittal from an unfounded charge must depend upon the man who is accused being able to prove a distinct alibi, *i.e.* he must prove his innocence. The statement of the child may be simple and artlessly made. At this tender age a girl may be easily induced, by the fear of punishment and by the aid of leading questions put by a parent, to admit that some one had committed an assault upon her. The statement once made may be persevered in, and its inconsistency may not always be brought out by cross-examination.

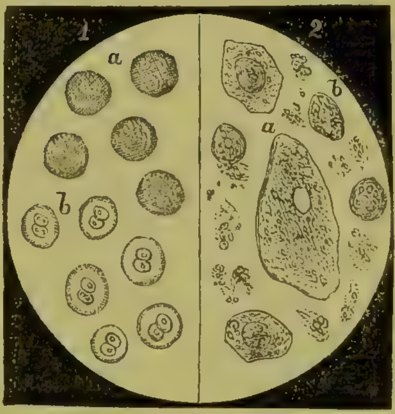
If the child is really labouring under *syphilis* or *gonorrhœa*, this is, *cæteris paribus*, evidence of impure intercourse, either with the ravisher or some other person; but we should be well assured, before giving an opinion, that the discharge is really of a gonorrhœal and not simply of a common inflammatory (purulent) character. The party accused, as in the case just related, might be at the time free from the disease, or, if labouring under it, then we should expect that the discharge had suddenly made its appearance in the child, with its usual severe symptoms, at a certain interval of time after the alleged intercourse—*i.e.* from the third to the eighth day. When these conditions do not exist, it is extremely difficult to form a medical opinion on the subject; since there are no certain means, by the microscope or otherwise, of distinguishing common purulent discharges from those which are gonorrhœal or syphilitic. In the annexed engraving (fig. 1) the microscopical appearance of the ordinary mucous discharges from the vagina is represented. Associated with the rounded granules of mucus there are large polygonal bodies which are epithelial scales, or pavement-epithelium. In fig. 2 the left side (1) represents the appearance of pus: *a* showing the characters of the normal globules, and *b* the same after treatment with acetic acid. On the right side (2) the mucous globules (*b*) are seen associated with epithelial scales, *a*. When microscopical evidence fails, proof can be derived only from non-medical sources. A case occurred to M. Biessy, in which a merely mucous discharge in a girl was pronounced to be syphilitic, and the person who was falsely accused of rape, narrowly escaped conviction. (Briand, 'Man. Complet de Méd. Lég.' 1846, p. 81.) The purulent matter of gonorrhœa does not differ microscopically from that produced in other forms of disease. It presents the characters shown in fig. 2 (1). Donné has given an illustration of the microscopical appearance of syphilitic pus from a chancre; the annexed engraving (fig. 3) represents a portion of his illustration. ('Cours de Microscopie.') It consists chiefly of pus-globules intermixed with vibrios (infusory animalcules).

Fig. 1.



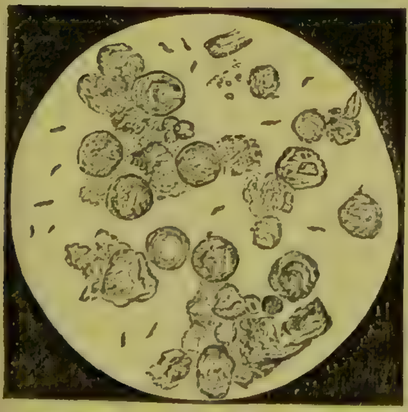
Microscopical appearance of mucous discharges magnified 500 diameters. (Gosse.)

Fig. 2.



Pus and mucus magnified 450 diameters. (Gosse.)

Fig. 3.



Pus from a chancre with vibrios. (Donné.)

We should further distinctly satisfy ourselves that gonorrhœa in a child, if it exist, could not have arisen from infection by any accident irrespective of intercourse. This limitation is rendered necessary by the publication of a report of two cases by Dr. W. B. Ryan ('Med. Gaz.' vol. 47, p. 744), in which two sisters, one of one year and the other of four years of age, received the infection by reason of their being washed in a vessel of water with a sponge used by a young woman affected with profuse gonorrhœal discharge. Dr. Ryan clearly traced the origin of the discharge to this unexpected accident. Had an accusation of rape been made against a man labouring under gonorrhœa, it is not at all improbable that this condition of the children, resulting from an unsuspected accident, would have been taken as an unanswerable proof of his guilt. Cases of this kind, thus accurately observed, convey an important caution to medical witnesses: *i.e.* that they should not infer criminal intercourse merely from the existence of a gonorrhœal discharge, in the absence of marks of violence to the genitals or of other strong corroborative proofs.

As a summary of these remarks with respect to purulent discharges, we may observe that they should not be admitted as furnishing corroborative evidence of rape, except,—1st, when the accused party is labouring under gonorrhœal discharge; 2ndly, when the date of its appearance in a child is from the third to the eighth day after the alleged intercourse; and 3rdly, when it has been satisfactorily established that the child had not suffered from any such discharge previously to the assault. It may be said, however, that all these conditions may exist, and yet the accused be innocent; for a child may, either through mistake or design, accuse an innocent person. This, however, removes the case entirely from the hands of a medical jurist. (The reader will find much useful information on this subject in a paper by Dr. Penard, 'Ann. d'Hyg.' 1860, vol. 2, pp. 130, 345.)

In the *Queen* v. *Mosely* (Cent. Crim. Court, Sept. 1843), the prosecutrix, a child between twelve and thirteen years of age, charged the defendant with having committed a rape upon her, alleging that she had made all the resistance in her power. Dr. Merriman stated that he examined the prosecutrix two or three days after the alleged offence was committed, but could not give any decided opinion upon the case, although there was every appearance of violence having been used. Another medical witness stated that the prosecutrix had been under his care for the last eight or nine days for a disease (gonorrhœa), with which, in his opinion, she had been infected for a considerable time; and a third proved that the prisoner was not infected with this disease. Dr. Merriman, however, is reported to have said that the prosecutrix was not labouring under the disease when he examined her. It is difficult to explain how this discrepancy on a matter-of-fact of some importance could have arisen. The jury acquitted the prisoner, probably not believing the statement made by the prosecutrix. In another case (*Reg.* v. *M'Donough*, Cent. Crim. Court, Oct. 1843), Mr. French and Mr. Tucker deposed that the gonorrhœa under which the prosecutrix (æt. 15) laboured had not existed longer than a week: it might have been of longer standing, but it certainly could not have existed for six weeks, the date at which it was alleged that the rape had been perpetrated by the prisoner, and the disease communicated. Upon this evidence the prisoner was acquitted. (See Casper's 'Gerichtliche Medicin,' vol. 2, p. 167.)

The following case was tried at the St. Louis Criminal Court. A man named *M'Comas* was charged with an attempt to violate a child æt. 9. The evidence against the prisoner was chiefly based on an extorted admission from the prosecutrix, and on the discovery on her clothes of certain stains supposed to have been produced by seminal fluid. The mother examined the genitals, and found them inflamed and discharging matter, although several weeks had elapsed since the alleged attempt. A medical practitioner was called to the girl; he found the nymphæ and orifice in a state of inflammation, which might have arisen from some morbid cause; but he was unable to give any positive opinion respecting the nature of the discharge. About eight days after this, the girl was examined by Dr. Stephens: the parts were still much inflamed, and discharging muco-purulent matter; the hymen was uninjured. The defence of the prisoner was, that he was not guilty of the assault, and that he was not labouring under gonorrhœa at the time of the alleged attempt. He was convicted and sentenced to three years' imprisonment. ('British American Journal,' May 1848, p. 19.) It is not improbable that this was a case of vaginal inflammation mistaken for gonorrhœa; for, as it has been already stated, there are no certain means of distinguishing the two kinds of discharges. The jury, however, appear to have put great faith in the testimony of the prosecutrix. The case was therefore decided by moral circumstances, and not by medical evidence. The existence of an unruptured hymen merely proved that there had not been a violent attempt at carnal intercourse.

With respect to marks of violence on the *body* of a child, these are seldom met with, because no resistance is commonly made by mere children. Bruises or contusions may, however, be found occasionally on the legs.

RAPE ON YOUNG FEMALES AFTER PUBERTY.

When the crime is committed on a girl from the age of ten to twelve years, the facts are much the same as those already referred to with respect to children below the age of ten years. There is, however, some difference in the legal complexion of the offence. If carnal intercourse be had with the consent of a female between the ages of ten and twelve years, the offender is guilty of a misdemeanor only (24 & 25 Vic. c. 100, s. 51); above the age of twelve years, the consent of the girl does away with any imputation of a legal offence. Girls who have passed this age are considered to be capable of offering some resistance to the perpetration of the crime; and therefore, in a true charge, we should expect to find not only marks of violence about the pudendum, but also injuries of greater or less extent upon the body and limbs. It is probable that in these cases, if the charge were well-founded, the hymen would be ruptured, as the intercourse is always presumed to be violent: but there might be some degree of penetration without this being a necessary result, especially if the membrane were small, or placed far up. At any rate, a girl at this age may sustain all the injury, morally and physically, which the perpetration of the crime can possibly bring down upon her, whatever may have been the degree of penetration; and for this reason, it is very properly laid down by our law, that the crime consists in the mere proof of penetration. The fact, however, is generally clearly made out by the statement of the girl. Girls of tender age are sometimes violated by boys; the amount of physical injury inflicted in such cases is less than when the assailant is an adult. In addition to other cases reported, Dr. Geoghegan, of Liverpool, has communicated to me one which was the subject of a trial at the Liverpool Winter Assizes of 1862. A boy aged seventeen committed a rape on two children, one aged eight years, and the other ten years; he then attempted to commit a rape on a third girl, aged eleven years. These crimes were perpetrated in about half-an-hour, during which time he was alone with the children. He was convicted of felony for rape on the youngest child, and sentenced to four years' penal servitude.

With respect to *marks of violence* on the person, the exact form, position, and extent of these should be noticed; because a false accusation of rape may be sometimes detected by the violence being in a situation in which it was not probable that the ravisher would have produced it. When bruises are found, the presence or absence of the usual zones of colour may occasionally throw light upon the time at which the alleged assault was committed. As these marks of violence on the person are not likely to have been produced with the concurrence of the girl, they are considered to furnish some proof of the intercourse having been against her will. But the physical appearances of rape about the genital organs may be found, whether the connection has been voluntary or involuntary. Thus rupture of the hymen, laceration of the vagina with effusion of coagula of blood, swelling and inflammation of the vulva, and stains of blood upon the person, dress, or furniture may be met with in both cases. In making an examination, the greatest care should be taken by the practitioner to fix, at the time of examination, a probable date for the marks of injury to the genitals or other parts of the body, as it is by the aid of such observations that the truth or falsity of a charge may be sometimes clearly established.

Girls and unmarried young women are liable to *muco-purulent discharges* from the vagina, as a result of which the hymen may be destroyed. This kind of discharge arises from inflammation of the vagina (vaginitis), and it has been observed to follow an attack of scarlatina. When it exists, its real cause requires the closest scrutiny. (See remarks by Dr. Barnes, 'Med. Gaz.' vol. 46, p. 65.) At a more advanced age, young women are frequently subject to leucorrhœa. These cases are not likely to be mistaken for gonorrhœa; as here the female has it in her power to give some account of the circumstances, from which a medical opinion may be easily formed. It is possible, however, that a woman labouring under leucorrhœa may charge a man with the crime of rape, and affirm that this discharge had arisen from the act of the man. An inflamed and partially ulcerated (aphthous) state of the lining-membrane of the vulva may apparently give support to the accusation. The discharge in leucorrhœa is of a mucous nature (see illustration, page 999, fig. 1)—that of gonorrhœa is of a purulent character—see page 999, fig. 2 (1); but purulent discharges may take place from the vagina as the result of intense inflammation, and quite irrespective of impure intercourse. ('Chelius's Surgery' by South, vol. 1, p. 160.) It would be impossible to distinguish such discharges from those of gonorrhœa; while a leucorrhœal discharge under great inflammatory action may resemble that of gonorrhœa.

Defloration. Signs of virginity.—It will be necessary to say a few words respecting the *signs of virginity*,—a subject upon which, in some medico-legal works, a great amount of poetical discussion appears to me to have been wasted. Independently of cases of rape, this question may occasionally assume a practical bearing in relation to the signs of defloration. In civil cases a medical witness may be asked whether a woman has ever had intercourse or not; and proof of the fact may be necessary in order to confirm or rebut statements made by her in evidence. The question may be not whether a female has had a child, for this would resolve itself into a proof whether delivery had or had not taken place:—it may be limited to the probability or possibility of intercourse on her part, at some antecedent period. Now, a medical jurist, when consulted in such a case, can only be guided by the presence or absence of the external signs of virginity. The hymen may be intact, but this does not prove non-intercourse, because females have been known to conceive with the hymen uninjured; and an operation for a division of this membrane has been frequently rendered necessary before delivery could take place. (Henke's 'Zeitschrift der S. A.' 1843, vol. 2, p. 149.) Two cases of impregnation without rupture of the hymen are reported in the 'New Orleans Medical Gazette' for June 1858 (pp. 217, 220). The hymen in each case required to be divided to allow of the delivery of the child. Another case is reported in the 'American Jour. Med. Science' for April 1859 (p. 576). These facts may be explained by the membrane being hard and resisting, and at the same time small in extent, *i.e.* only partially closing the vagina. Under opposite conditions, the persistence of this membrane might fairly lead to the inference that the female was chaste, and that there had been no intercourse; but the hymen may be destroyed by ulceration, as a result of inflammation of the genital organs. When the membrane has been thus destroyed by disease or other causes, or when it is congenitally absent, a medical opinion must be more or less conjectural; for one intercourse could hardly so affect the capacity of the vagina, as to render the fact evident through life, and there is no other datum upon which an opinion could be based. The presence of the hymen is of course quite incompatible with the assumption that the female has borne a child. A question of this kind incidentally arose in *Frazer* v. *Bagley* (Common Pleas, Feb. 1844.) It was alleged by defendant that the plaintiff, a married man, had had adulterous intercourse with a young woman, and that at an antecedent period she had left her home for the purpose of giving birth to a child privately. The late Dr. Ashwell was called upon to examine the woman, and he deposed that, in his opinion, she was a virgin, and had never had a child. In spite of this evidence, the jury returned a verdict for the defendant. It is possible, however, that abortion may take place at the early periods of pregnancy, without the necessary destruction of the hymen. (See Henke, ‘Zeitschrift,’ 1844, vol. 1, p. 259.)

The question may become of importance not only as it may affect the reputation of a female, but the credibility and character of the person who makes the imputation of a want of chastity. In 1845, a gentleman, then assistant-surgeon in the Bombay Army, was brought to a Court-Martial on a charge of having deliberately and falsely asserted that on several occasions he had had connection with a native woman. This was denied by the woman, and evidence was adduced to show that she had still what is commonly regarded as the main sign of virginity, namely, an unruptured hymen. In consequence of this, the gentleman was found guilty, and cashiered. The woman was at the time about to be married, and this rendered the investigation all the more important to her. An assistant-surgeon, who examined the girl, deposed that he found the membrane of a semilunar form, and tensely drawn across the vagina; and his evidence was corroborated by that of a midwife. The inculpated person took up a double line of defence—1st, that the examination of the woman was incomplete; and 2dly, that the hymen, if present, would not justify the witness in saying that intercourse could not possibly have taken place. On the first point, it is unnecessary here to make a remark; but it appeared, from their own admissions, that the witnesses had never before examined women with this particular object. Assuming that there was no mistake, it becomes a question whether non-intercourse could in such a case be inferred from the presence of the membrane. Fruitful intercourse, it is well known, may take place without rupture of the hymen. Some instances of this kind were referred to at the Court-Martial; but such cases may be regarded as of an exceptional nature. The real question is, whether, unless the hymen be in an abnormal state, intercourse can possibly occur between young and active persons without a rupture of this membrane. Intercourse is not likely to be confined, under these circumstances, to a mere penetration of the vulva. The membrane in this woman is stated to have been tensely drawn across the canal, and it was not tough; it was therefore in a condition to render it most easy for rupture. In the case of an old man, or of one of weak virile power, vulval intercourse might be had without destroying the membrane; but such a case could only be decided by the special circumstances which accompanied it. The presence of the hymen unruptured affords a presumptive but not an absolute proof that the woman is a virgin; and if of the ordinary size and shape, and in the ordinary situation, it shows clearly that, although attempts at intercourse may have been made, there can have been no vaginal penetration. Admitting the statements of the examiners to be correct, it is improbable that this woman had had sexual intercourse several times, or even on one occasion; hence the imputation on her chastity was unfounded.

In the case of *Delafosse* v. *Fortescue* (Exeter Lent Ass. 1853), which involved an action for defamation of character, the plaintiff, a married man, æt. 64, had been charged with committing adultery with a certain woman. Several witnesses for the defendant positively swore that they had seen these persons in carnal intercourse. This was denied by the plaintiff; and, as an answer to the case, medical evidence was tendered to the effect that the woman with whom the adulterous intercourse was alleged to have taken place had been examined, and the hymen was found intact. In cross-examination this was admitted not to be a conclusive criterion of virginity. A verdict was returned for the defendant. The form and situation of the hymen in this case were not described; but it is to be presumed that these were not such as to constitute a physical bar to intercourse, or this would have been stated by the medical witness. Hence the existence of the membrane was not considered to disprove the allegations of eyewitnesses. In Scotland this kind of medical evidence is not admissible. I am indebted to Mr. Trayner, a member of the Scotch Bar, for the subjoined case, in which a wife sued the husband for divorce, on the ground, *inter alia*, that he had committed adultery with C. In defence the defendant denied the adultery, and adduced C. as a witness, who swore that such connection had never taken place. She also swore that she had submitted to an *inspectio corporis* by Professor Simpson. The defendant then proposed to examine Dr. Simpson, that he might speak to the result of his examination. He argued that this was the best evidence that he could adduce in support of his innocence, as if the girl was still a virgin the adultery alleged could not have been committed. The Court refused to admit the evidence, on the ground that the evidence proposed was merely that of an opinion from the learned professor; that other medical men might differ from him in opinion, even from the same observations; and that, as the Court could not compel C. to submit to another examination, the proposed evidence must be considered *ex parte* and inadmissible. (Session Cases, Edinburgh, Feb. 11, 1860.) In *Hunt* v. *Hunt* a verdict was obtained at common-law against the alleged paramour in a case of adultery, and the damages were assessed at £50. It was subsequently proved that the lady was *virgo intacta!* So long as there are facts which show that women have actually conceived with the hymen still in its normal state, it is inconsistent to apply the term 'virgo intacta' to women merely because this membrane is entire. A woman may assuredly have an unruptured hymen, and yet not be a virgo intacta. This can only be decided by the special circumstances proved in each case. Such *virgines intactæ* have frequently required the assistance of accoucheurs, and in due time have been delivered of children!

CHAPTER 78.

RAPE ON MARRIED WOMEN—CIRCUMSTANCES UNDER WHICH IT MAY BE PERPETRATED ON ADULT WOMEN—LOSS OF PHYSICAL EVIDENCE—PREGNANCY FOLLOWING RAPE—MICROSCOPICAL EVIDENCE—EVIDENCE OF VIOLATION IN THE DEAD BODY—SODOMY—BESTIALITY.

THE remarks already made apply generally to married women, with this difference,—that when a female has already been in habits of sexual intercourse, there is commonly much less injury done to the genital organs. The hymen will, in these cases, be found destroyed and the vulva dilated. Still, as the intercourse is presumed to be against the consent of the woman, it is most likely that when there has been a proper resistance some injury will be apparent on the pudendum; and there will be also, probably, extensive marks of violence on the body and limbs. Such cases are generally determined without medical evidence, by the deposition of the woman, corroborated, as it should always be, by circumstances. An experienced barrister has suggested to me that this statement regarding the presence of *marks of violence* on the pudendum of a married woman, on whom a rape is alleged to have been committed, requires some qualification. He informed me that he was concerned in the prosecution of two cases of rape on married women, in which the crime was completed in spite of the resistance of the women, and there were no marks of violence on the genital organs in either case. In one (*Reg.* v. *Owen* and *others*, Oxford Circuit, 1839), it appears that while an accomplice held the head of the woman with her face downwards between his thighs, the prisoner had forcible intercourse with her from behind,—her thighs having been first widely separated. In the second case an accomplice held the woman down on a bed by her neck, while the prisoner separated her thighs, and thus had intercourse with her. She was examined nine hours afterwards by an experienced surgeon, and he found no mark or trace of violence or injury on or anywhere near her pudendum. There were bruises on her arms, neck, and legs, where she had been forcibly held down. In each of these cases, it will be seen that the woman had not to struggle with a single assailant; and there can be no doubt that if a married woman is rendered powerless by many persons being combined against her, or if she is rendered insensible by intoxicating drinks or narcotic vapours, a rape may be perpetrated without any injury whatever to the genital organs. The gentleman to whom I am indebted for the above cases has suggested that a separation of the thighs in a married woman will cause such a dilatation of the parts, as to render it easy for the male organ to penetrate the vagina without leaving any traces of violence on the labia or the female organs generally. This is undoubtedly the true explanation.

On the other hand, the vagina may be the seat of violence, and no marks to indicate a struggle or the application of force be found on the body. I was consulted, in April 1862, on a case of this description. A woman was knocked down, her clothes were pulled over her face, and the crime of rape was perpetrated by the assailant. In the position in which she was held, with her arms and hands covered over, she was half suffocated and unable to offer any effectual resistance. She was examined on the evening of the day of the assault by Dr. Mayne. He found no marks of violence on her body, but the mucous membrane of the vagina at its commencement was contused, and in some portions lacerated: blood was oozing from these parts. It was properly considered that, under these circumstances, the statement of the woman was consistent with the fact that there were no marks of violence on her body. There was no reason to suppose that the injury to the vagina had been caused in any other way than by a criminal assault.

When a charge of rape is made by a prostitute, it is justly received with suspicion, and the case is narrowly scrutinized. Something more than medical evidence would be required to establish a charge under these circumstances. The question turns here, as in all cases of rape upon adult women, on the fact of *consent* having been previously given or not. This is the point at which the greater number of these cases of alleged rape break down; and it need hardly be observed, that this question has no relation to the duties of a medical witness:—all that he can do is to establish, occasionally, whether or not sexual intercourse has been had with or without some violence. It is obvious that there may be marks of violence about the pudendum, or on the person, and yet the conduct of the woman may have been such as to imply consent on her part: we must not suppose that medical proof of intercourse is tantamount to legal proof of rape.

Possibility of perpetrating rape on adult women.—Some medical jurists have argued that a rape cannot be perpetrated on an adult woman of good health and vigour; and they have treated all accusations made under these circumstances as false. Whether, on any criminal charge, a rape has been committed or not, is of course a question of fact for a jury and not for a medical witness. The fact of the crime having been actually perpetrated, can be determined only from the evidence of the prosecutrix and of other witnesses; still a medical man may be able to point out to the Court circumstances which might otherwise escape notice. Setting aside the cases of infants, idiots, lunatics, and weak and delicate or aged women, it does not appear probable that intercourse could be accomplished against the consent of a healthy adult, except under the following conditions:—

1. When narcotics or intoxicating liquids have been administered to her, either by the prisoner or through his collusion. It matters not, in a case of this kind, whether the narcotics have been given merely for the purpose of exciting the female, or with the deliberate intention of having intercourse with her while she was intoxicated,—the prisoner is equally guilty. (See *Reg.* v. *Camplin*, 'Law Times,' June 28, 1845; also 'Med. Gaz.' vol. 36, p. 443.) The nature of the substance whereby insensibility is produced is of course unimportant. Thus the vapours of ether and chloroform have been criminally used in attempts at rape. In a case which occurred in France, a dentist was convicted of a rape upon a woman, to whom he had administered the vapour of ether. The prosecutrix was not perfectly unconscious, but she was rendered wholly unable to offer any resistance. ('Med. Gaz.' vol. 40, p. 865.) A dentist was recently convicted of rape under somewhat similar circumstances in the United States, but it was thought that the woman had made the charge under some delusion. In *Reg.* v. *Snarey* (Winchester Lent Assizes, 1859), there was a clear attempt at fraud. The prosecutrix asserted that she was *instantly* rendered insensible by the prisoner forcibly applying a handkerchief to her face, and she accused him of having committed a rape on her. The charge was disproved by a distinct alibi, as well as by the improbability of all the circumstances. Casper met with a solitary case in which a girl æt. 16 accused a man of having had intercourse with her while she was sleeping in her bed, of which she was not conscious until he was in the act of withdrawing from her. On her own statement she was *virgo intacta* up to the date of this occurrence. Upon the facts of the case, Casper came to the conclusion that, if her statement was true, the man could not have had intercourse with her without causing pain and rousing her to a consciousness of her position. The hymen was not destroyed, but presented lacerations in two places. This and other facts showed that there had been intercourse, but did not prove that this had taken place without the consciousness of the woman. ('Klinische Novellen,' 1863, p. 31.)

In March 1863 a girl of fifteen was tried, at the Central Criminal Court, on a charge of having murdered her illegitimate child. The prisoner stated, in her defence, that as she was returning home one evening, a man put something to her mouth which rendered her quite unconscious, and she had no idea she was pregnant, when she was suddenly delivered of the child. In *White* v. *Howarth* (Liverpool Winter Assizes, 1861), it was alleged that the defendant's daughter having gone to consult the plaintiff, who was a dentist, he took an opportunity of rendering her suddenly insensible by chloroform, and then had intercourse with her. In cross-examination, however, it transpired that the girl was not rendered insensible at all, but was conscious of all that was going on, and she might have given an alarm but did not. Most of these stories when properly examined will be found inconsistent and untrue. It is not the property of chloroform or of any narcotic substance, in a safe dose, to render a person instantaneously insensible and powerless. In *Bromwich* v. *Waters* (Chester Lent Assizes, 1863, p. 825), it was alleged on the part of the plaintiff, that the defendant had given to the woman Whalley some liquid, which she had only tasted, and then suddenly became unconscious. It was suggested that while in this state the defendant had had intercourse with her, which he denied; the woman herself alleged that she was not conscious of her pregnancy until some months after this visit. But such symptoms could not be reasonably ascribed to any of the known narcotic substances. If given in a safe dose their effects are slowly and gradually produced; if they come on in a few minutes, the dose must have been large, and then it is probable the person would die.

When the state of unconsciousness arises from natural infirmity, as in idiocy or insanity, carnal intercourse with a woman is regarded as rape. (*Reg.* v. *Ryan*, Cent. Crim. Court, September 1846.) The woman was in this case an idiot, and it was proved that her habits were not loose or indecent. Platt, B., held that if she was in a state of unconsciousness at the time the connection took place, whether it was produced by any act of the prisoner or by any act of her own (?), anyone having intercourse with her would be guilty of rape. The prisoner was convicted. In *Reg.* v. *White* (Northampton Winter Assizes, 1856), the learned judge, in charging the jury, stated that some doubts were entertained whether the crime of rape could be committed (in law) on the person of a woman who had rendered herself perfectly insensible by drink, so as to be unable to make any resistance: he thought it could not be alleged as an excuse for the man. The question was not reserved, as the prisoner was acquitted of rape, and found guilty of an indecent assault.

It may be a question whether a man can have intercourse with a woman without her knowledge while thus in a state of *unconsciousness from natural sleep*. A man was charged with rape before a police-magistrate, and the prosecutrix swore that he had effected his purpose during her sleep. The bare possibility of the offence being perpetrated under these circumstances cannot be denied; but this admission could only apply to a case in which the woman had been accustomed to sexual intercourse, and in which the sleep was preternatural or lethargic. In this instance the woman was a prostitute, and the charge improbable. A respectable married woman who had had children, the wife of an innkeeper, threw herself on her bed with her clothes on, late one evening, and fell fast asleep. She was first awakened by finding a man upon her body, in the act of withdrawing from her. This man, *William McEwan*, a servant in the house, was given into custody on a charge of rape. In the first instance he did not deny the act, and there was no reason to believe that the prosecutrix was aware of the prisoner's conduct until the crime was completed, and she was awakened in the manner described,—apparently by the weight of the prisoner's body. The prisoner was convicted, and sentenced to ten years' penal servitude. ('Edin. Month. Jour.' December 1862, p. 570.) A case which may serve to throw a little light upon this question occurred to Casper. ('Gerichtliche Medicin', vol. 2, p. 574.) A married woman alleged that a man had had intercourse with her while in bed, and when she was asleep. In her deposition, however, she admitted she was conscious that some one was lying upon her, and that she asked who it was; showing, as Casper remarks, that she had a knowledge of what was going on, and a *doubt* whether the person was her husband.

In reference to the question whether it is possible to commit rape upon a woman while asleep, a majority of the Scotch judges recently decided, in the case of *Sweenie* (Irvine's 'Justiciary Reports,' vol. 3, p. 109), that the feloniously having connection with a woman while asleep was not indictable under the name of rape, inasmuch as, apart from the force implied in the act of connection, there was no force used to overcome the will of the woman. But they held, however improbable it might be, it was quite possible that a man might have connection with a woman while asleep. ('Edin. Month. Jour.' December 1862, p. 570.)

The condition of the so-called *magnetic* or unnatural sleep has given rise to a question connected with the alleged perpetration of rape. A girl (æt. 18) consulted a therapeutic magnetizer as to her health. She visited him daily for some days. Four-and-a-half months afterwards she discovered that she was pregnant, and made a complaint to the authorities against the magnetizer. They directed a physician and surgeon to determine the date of her pregnancy, and whether complainant might have then been violated and rendered pregnant contrary to her will, *i.e.* if her volition could have been completely or partially annihilated by magnetism. The medical inspectors were satisfied that the pregnancy did not extend further back than four-and-a-half months; and founding their opinion on M. Husson's report, made to the Academy in 1831, concluded that as a person in magnetic sleep is insensible to every kind of torture, sexual intercourse might then take place with a young woman without the participation of her will, and without her being conscious of the act, and consequently without her being able to resist the act consummated on her. This opinion was confirmed by that of Devergie. ('Gazette Médicale de Paris,' and 'Edin. Month. Jour.' December 1860, p. 566.) There is another view of this case which does not seem to have occurred to the French medical experts, namely: '*Non omnes dormiunt quæ clausos habent oculos.*'

The state of the mind during the act of waking from natural sleep, *i.e.* when a person is in a half-conscious state, may also give rise to a question connected with rape. In *Reg.* v. *Clarke* (York Autumn Assizes, 1854), prisoner was charged with having committed a rape on prosecutrix. The woman had been married to her husband six years, and had had three children. Prisoner took advantage of his absence from home to get into the bed of prosecutrix, about two o'clock in the morning: she mistook him for her husband, and under this mistake allowed him to have intercourse with her. It was only some time afterwards that she found it was the prisoner, and not her husband, who was in bed with her. The jury convicted him on this evidence. The case was reserved by Crowder, J., for the opinion of the judges whether the offence amounted to rape, as it was not included in the ordinary definition, *i.e.* of carnal knowledge by force and against the will of the woman. In *Reg.* v. *Rackstraw* (Cent. Crim. Court, 1863), and *Reg.* v. *Jackson*, in both of which intercourse had been had with women under similar circumstances, it was held that the offence did not in law amount to the crime of rape. In the former case, the prisoner was tried and found guilty of an unlawful assault on the prosecutrix. Keating, J., then stated, that where a man personated the husband, the act of intercourse did not amount to rape, because it was done with the assent of the woman. The prisoner, in his defence, stated that the intercourse had taken place by the woman's consent, and that she had invited him; but this she denied, and the circumstantial evidence in the opinion of the Court tended to negative the prisoner's statement: he was convicted of an assault and sentenced to imprisonment. It is a curious psychological question, however, whether a woman can have connection, under these circumstances, without at least entertaining a suspicion that the man is *not* her husband. It is a matter of great doubt, when intercourse has thus been had in the waking state, whether the act could take place without the tacit assent of the woman.

2. A rape may be committed on an adult woman if she falls into a state of syncope, or is rendered powerless by terror and exhaustion. An eminent judicial authority has suggested to me that, in his opinion, too great distrust is

commonly shown in reference to the amount of resistance offered by women of undoubted character. Inability to resist from terror, or from an overpowering feeling of helplessness, as well as horror at her situation, may lead a woman to succumb to the force of a ravisher, without offering that degree of resistance which is generally expected from a woman so situated. As a result of long experience, he thinks that injustice is often done to respectable women by the doctrine that resistance was not continued long enough.

3. When several are combined against the female, in which case we may expect to find some marks of violence on her person, if not on the genital organs.

4. A woman may yield to a ravisher, under threats of death or duress: in this case her consent does not excuse the crime, but this is rather a legal than a medical question. An aged woman can scarcely be expected to resist a strong man. Dr. Chevers mentions a case in which a man was convicted of rape and aggravated assault on a woman of *seventy* years of age.

Loss of physical evidence.—It is necessary to observe, in relation to the examination of females, whether girls or women, that the marks of rape, however well-marked they may be in the first instance, either soon disappear or become obscure, especially in those who have been already habituated to sexual intercourse. After two, three, or four days, unless there has been an unusual degree of violence, no traces of the crime may be found about the genital organs. In the case of an adult married woman examined by Dr. Mayne, the appearances of injury which he discovered in and about the vagina had begun to heal in less than forty-eight hours; but in a case examined by Casper, on the ninth day the lining-membrane of the vagina was still reddened, and the parts were painful. In this case the hymen was completely torn through. ('Gerichtliche Medicin,' vol. 2, p. 157.) In married women, or in those accustomed to sexual intercourse, no inference can be drawn from a dilated state of the vagina. In unmarried women, and in children when there has been much violence, these marks may persist and be apparent for a week or longer. Supposing at the period of examination no such marks exist, it may be necessary to consider whether there has been time for them to disappear since the alleged perpetration of the offence; but in such cases it is rarely in a witness's power to express an affirmative opinion of the perpetration of the crime: he must leave this to be proved by the general and circumstantial evidence. Casper met with a case in which a man æt. 37 committed a rape on a girl only eight years of age: he was seen in the act, and defended himself on the plea of drunkenness. The girl was examined by a medical man on the day following,—the labia were reddened, and there was injection of the membrane at the entrance of the vagina which was very sensitive. As an illustration of the rapidity with which the marks of rape disappear in young children, when not ttended with great physical injury, it may be stated that this girl was carefully examined by Casper *eleven days* after the assault. The sexual organs were then in their natural state; there was not the least appearance of local njury, and no inference could have been drawn at this date, that the girl had been subjected to any violence.

Medical practitioners are not always sufficiently careful in the inferences which they draw from an examination of children at distant periods after an lleged rape. They allow themselves to be deceived by a plausible story, apparently consistent, and thus see proofs of rape on examining the sexual organs f a girl many weeks after the alleged perpetration of the crime; whereas, had he girl been brought before them as a casual patient, and they had heard othing of violent intercourse, they would have probably ridiculed the idea of etting up a charge of rape on so slender a foundation. The delay in having he examination made, unless satisfactorily explained, is always a suspicious ircumstance in itself. I was present at the Assizes on one occasion, when a man was tried on a charge of rape on a girl a little above seven years of age. About *six weeks* had elapsed before the girl was seen and examined by the medical man who was the only witness for the prosecution; and after this long date he was prepared to swear, at the trial, that a rape had been perpetrated on the child! Fortunately for him, the prosecutrix, as usual, was first called as a witness. The child, under cross-examination, swore that all that she had previously stated before the magistrates regarding the prisoner was untrue; and her evidence so clearly established the innocence of the man, that the case broke down, and he was at once acquitted by the jury. But for the medical evidence against him, this man could not have been committed for trial on the charge; and it is therefore desirable to consider the medical facts and opinions on which he was imprisoned for a long period on what proved to be a false charge. From his examination the medical man came to the conclusion that the girl had been violated six weeks before he saw her. There had, in his opinion, been penetration; the vagina was unnaturally dilated; there was a discharge from it, and an abrasion on the left side; the mucous membrane was generally inflamed. "Such appearances might have existed as the result of violence perpetrated on them three months previously! He had frequently examined the girl since, and his conclusions from the first examination had been confirmed. In cross-examination he said he thought the appearances could not be the result of accident; it was not impossible but improbable that they might be so." From what has been already stated on the medical proofs of rape, it will be obvious—1. That in this case there was no evidence of penetration by the male organ, and that the appearances after six weeks had elapsed did not in any way justify such an opinion from an examination made.—2. That the discharge, the abrasion, and the inflammation of the vagina were all explicable on other grounds, and did not prove that a rape had been committed on the girl at the date assigned. It is highly probable that this child was suffering under that kind of inflammation and purulent discharge from the genital organs, which has been elsewhere described as a fertile source of medical errors (p. 996, *ante*); but whether this be admitted or not, there was not the slightest proof, from the facts, that this girl had ever been violated, even supposing that her own evidence had not shown that the medical man had come to a wrong conclusion from the data before him. Dilatation of the vagina, if really present, could not have been the result of only one attempted intercourse with a child of such tender years, six weeks before the date of examination.

When there has been great laceration of the sexual organs, then certain appearances in the form of cicatrices may remain; but in all cases great caution should be observed in giving an opinion of rape having been perpetrated, from an examination made even two or three weeks after the alleged commission of the offence. Any innocent person might be convicted of rape upon medical evidence such as this, given after the lapse of six weeks from the date of the occurrence. Marks of violence on the person can never establish a rape; they merely indicate, *cæteris paribus*, that the crime may have been attempted.

Pregnancy following rape.—It was formerly a debated question, whether, in a case of real rape, pregnancy could possibly follow; and this was even proposed as a rude test of the truth of a charge made by a woman! This question scarcely requires discussion. Such a defence would not be admitted as an answer to a charge of rape, or to show under any circumstances that intercourse had been voluntary on the part of a woman. Conception, it is well known, does not depend on the consciousness or volition of a female. If the state of the uterine organs be in a condition favourable to impregnation, this may take place as readily as if the intercourse was voluntary: even penetration is not absolutely necessary for impregnation. (See case by Dr. Oldham, 'Med. Gaz.' vol. 44, p. 48.) I am indebted to the late Mr. Carrington for a case in which a woman became pregnant after a rape committed on her by a man who subsequently married her: the date of intercourse was accurately fixed, and a child was born after 263 days' gestation (see *ante*, p. 813).

It has been supposed, that in these cases of pregnancy following rape, in spite of resistance at first, a woman may in the end have voluntarily joined in the act. I know of no ground for adopting this theory: the general opinion is, that conception may occur, and is neither accelerated nor prevented by the volition of the sexes. Many women in married life who anxiously wish for children have none, and *vice versâ*; and physical impediments do not suffice in all cases to explain these facts. Women are reported to have conceived during the states of asphyxia, intoxication, and narcotism. Dr. Ryan mentions a case in which a young woman became unconsciously pregnant from intercourse had with her by a man while she was in a state of intoxication, and in which it was clearly impossible that her volition could have taken any share. ('Med. Juris.' p. 245.) In married life there is no doubt that women frequently become pregnant against their will, and in a great number of cases without any consciousness of their condition until pregnancy is far advanced. Those who affirm that without the active will of the woman there can be no conception, must deny the existence of cases of impregnation in a state of unconsciousness (p. 759): but the facts are too strong and too numerous to be met with a simple denial. A medical jurist, therefore, who relied upon pregnancy following alleged rape, as a proof of *consent* on the part of the woman, and who would infer from this result that the intercourse must have been voluntary on her part, would inflict great injustice by such an opinion. The extrusion of an ovum does not depend on the will of a woman, but is a periodical condition; the action of the spermatozoa on this ovum is as much removed from the will of the woman as it is from that of the man.

This subject would have hardly required so much notice, but for the fact that in some recent trials it has been put forward with a view to discredit the evidence of a woman, where pregnancy has followed intercourse in a state of alleged unconsciousness. Any statement of this kind always requires a close examination, because, generally, there is a strong motive for falsehood on the part of a woman. In the case of *Bromwich* v. *Waters* (*ante*, p. 825), the young woman Whalley had had a child, but stated that she had not been conscious of any intercourse. The fact that she had borne a child did not prove that her statement was false, although a suggestion to this effect was made. We may fairly doubt whether a woman could have intercourse unconsciously, but because impregnation follows, this is no proof that she is guilty of falsehood or perjury.

Microscopical evidence.—As part of the medical evidence in cases of rape, it may be necessary to examine *spots or stains* on the linen of the prosecutrix and the accused. ('Ann. d'Hyg.' 1834, p. 210: 1839, p. 134.) Cases of rape are commonly tried in this country without reference to this species of evidence; and it is not easy to perceive how this can be necessary to the proof of the crime in the living, when the present law of England demands only proof of penetration, and not of *emission.* (24 and 25 Vict., c. 100, s. 63.) Thus, a rape may be legally completed without reference to emission; and, medically speaking, it appears quite possible that there might be marks of emission without any penetration. Admitting that certain stains of this description are found on the clothes of an accused person,—Are these to be taken as furnishing undeniable proof of the legal completion of rape? It appears to me that without corroborative evidence from the state of the female organs they cannot be so taken; and therefore the affirmative evidence from the microscope, under these circumstances, is as liable to lead to error as that which is purely negative.

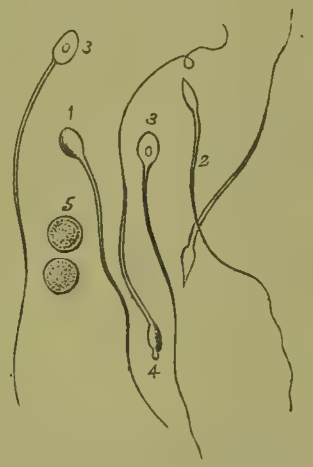
The fact that spermatic stains are found on the linen of the prosecutrix may, however, become occasionally of importance in charges of assault with intent, as the following case (*Reg.* v. *Hamilton*) which was tried at Edinburgh, Nov. 27, 1843, will show. The prisoner, who was at the time labouring under gonorrhœa, was charged with a criminal assault upon a child. The shift worn by the prosecutrix, with other articles belonging to the prisoner, was submitted to Mr. Goodsir and Dr. Simpson for examination. Some of the stains on the linen were of a yellow colour, and were believed to be those of gonorrhœa; others, characterized by a faint colour and particular odour, were considered to be stains caused by the spermatic secretion. When placed in water, they yielded a turbid solution of a peculiar odour, and when this was submitted to a powerful microscope, spermatozoa were detected. The majority of them were mutilated, the long slender filaments being broken off; but perfect specimens were seen, which differed from the living spermatozoa only in being motionless. The stains on the linen of the prisoner and the prosecutrix were similar. The prisoner was convicted of an assault with intent to ravish, and sentenced to transportation for fourteen years. ('Cormack's Edin. Jour.' April 1844.) In a case of rape perpetrated on a child, Dr. Sawyer found, in addition to blood-corpuscles and spermatozoa, some woollen fibres of a blue and red colour. This observation aided in fixing the identity of the assailant, since it was proved that the man wore a red flannel shirt over a bluish-grey woollen shirt. ('New Orleans Med. Gaz.' June 1858, p. 281.)

Examination of stains.—There are no chemical tests on which we can safely rely for the detection of spermatic stains. The appearance produced by a dried spermatic stain on linen or cotton is like that produced by a diluted solution of albumen. The fibre of the stuff is stiffened, and the stain, particularly at the margin, has a slightly translucent appearance, as if wetted by diluted gum or albumen, but without any shining lustre. In the dry state the stain presents no well-marked colour or odour. Slips of the stained linen, when soaked in a small quantity of distilled water, yield a muco-albuminous liquid, slightly alkaline. It was long since noticed by Orfila that this liquid, unlike a solution of albumen, was rendered rather strongly yellow by diluted nitric acid. By the action of warm water, the stained linen, even although it may have been kept dry for a considerable period, has been observed to evolve the peculiarly faint odour of the spermatic secretion.

The microscopical detection of spermatozoa in these stains is attended with some difficulty when the stained stuff has been much rubbed or worn, or is of a very coarse nature. M. Donné, in his early experiments, failed in discovering these bodies in dried stains. ('Cours de Microscopie,' p. 304.) This was probably owing to the faulty methods of proceeding adopted by some of the French medical jurists. Thus, they have recommended that the stained linen should be soaked in so large a quantity of water as to require filtration; that it should be macerated for many hours; that warm water should be used; and that ammonia, or other chemical agents, should be employed. These circumstances will account for the non-detection of these minute fragile filaments, as they are liable to be destroyed by such methods of research. The plan which I have found the most simple is that recommended by Dr. Koblanek, of Berlin. (Casper's 'Vierteljahrschrift für Gerichtliche Medicin,' 1853, 3 B., 1 Heft, p. 140.)

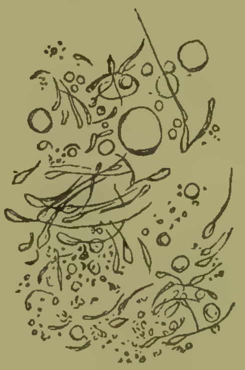
The stained linen, or a portion of it, should be cut out, taking care that it is not roughly handled. It should be placed in a small porcelain capsule, with a sufficiency of cold distilled water (eight or ten drops) to soak it thoroughly, and to allow the fibre of the stuff to become quite penetrated by the water. Unless the stained stuff is very coarse, or is not easily penetrable by water, the necessary digestion will be completed in a quarter of an hour. The stained linen may then be removed, and any water loosely adhering to it allowed to drain from it. The soaked portion of the stain should then be squeezed, so that some drops of the liquid may be collected on several glass-slides, already well cleaned and prepared for the purpose. The liquid thus obtained by squeezing the stained linen is slightly opaline. It should now be covered with thin microscopic glass, and examined by a microscope under powers varying from 300 to 500 diameters, in a strong light. At 319 diameters the spermatozoa are fairly visible, but require a careful adjustment of the microscope in order to be distinctly seen; the head often coming into focus before the long filamentous tail, and when this is seen the head may be lost. The spermatozoa are best seen in a good light, with a power of 500 diameters: the head is ovoid and flattened—sometimes rather pointed; the tail is from nine to twelve times the length of the head. Micrometrical measurements of two, gave, for the total length including the head—in one the 1-750th of an inch, and in the other the 1-1000th of an inch; the head, in its greatest diameter, was in each about 1-9000th of an inch; the filiform tail tapers to a scarcely visible point. The spermatozoa are usually associated with granular bodies, and with epithelial scales (see illustration, p. 938). Fibres of cotton, linen, or wool may be also mixed with them (see p. 429); and they may be associated with pus, mucus, and blood-globules. Their form is so peculiar that, when once well seen and examined, they cannot be mistaken for any other substance, vegetable or animal, nor, with ordinary care, can any vegetable fibres be mistaken for them. In the annexed illustration (fig. 1), the forms of

FIG. 1.



Spermatozoa. (Sharpey.)

FIG. 2.



Spermatozoa in stains after two years (Gosse) magnified 500 diameters.

he spermatozoa are delineated: in 1 to 4 their variety of appearance is shown: , seminal granules. Fig. 2 represents the appearance of the reproduced spernatozoa in a stain which had been two years in a dried state; the rounded odies represent fatty granules associated with the spermatozoa. (See 'Des aches au point de Vue Medico-legalé,' par Dr. H. J. Gosse, 1865, p. 94.)

In these investigations medical evidence should be based on the undoubted etection of a perfect spermatozoon. Minute fibres might be mistaken for the ils, and therefore it is desirable not to base an opinion on fragmentary vidence of this description. Dr. Beale has published a case in which bodies losely resembling spermatozoa were found in the urine of a woman, a patient St. George's Hospital. ('Archives of Medicine,' No. 3, 1858, p. 251.)

Dr. Koblanek expresses the opinion that when they are not discovered by the process above described, it may be considered that the stains are not due to the spermatic secretion: in this, however, he is in error. When the stained article of dress is of very coarse texture, when it has been much rubbed, much worn, or wetted by urine, blood, mucus, or pus, it will be a matter of considerable difficulty to discover these bodies, although there may really have been spermatic stains upon it. Most of these foreign substances, however, may be removed by the addition of one or two drops of acetic acid, which exerts no dissolving action on the bodies of the spermatozoa unless too concentrated.

As it has been elsewhere stated (*ante*, p. 862), these bodies, although peculiar to the seminal fluid, are not found in the very young, the very old, or in those who are labouring under long-standing disease of the testicles. Even in the cases of healthy married men, who have had children, spermatozoa are not always found in the spermatic secretion; their presence, size, and number are subject to great uncertainty. Exhaustion from frequent intercourse, or constitutional causes, without actual bodily disease, appear to influence their production. There are also various other conditions in which they are not found; these have been fully examined by Casper ('Gerichtliche Medicin,' vol. 2, p. 141), and the numerous cases which he has collected clearly establish this conclusion. The discovery of spermatozoa in stains on articles of clothing demonstrates that the stains have been produced by the spermatic liquid; but their non-discovery, under these circumstances, does not prove that the stains have not been caused by this liquid. Dr. Koblanek's views on this subject are therefore not borne out by facts.

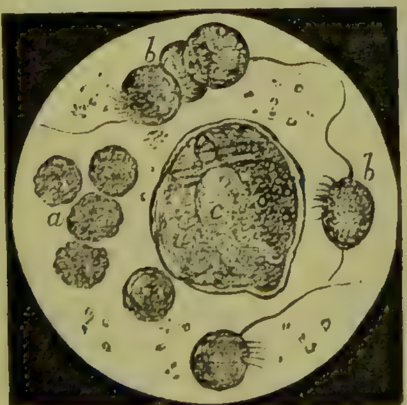
There can be no doubt that a crypsorchid is capable of committing a rape. According to some observers (p. 866), the spermatic fluid emitted by such persons contains no spermatozoa. In some instances this is no doubt the case, but as a rule we may expect to find that stains produced by the spermatic fluid of such persons would present the usual characters under the microscope. At page 867, cases have been related which clearly prove that crypsorchids can procreate like normally-constituted men, and Casper furnishes an instance in which spermatozoa were detected by him in the fluid emitted by a crypsorchid. ('Gerichtliche Medicin,' vol. 2, p. 187.) The case is otherwise remarkable from the fact that the crypsorchid boy was only fourteen-and-a-half years old, and had been guilty of unnatural conduct towards another boy eight years of age; sixteen days after the act spermatozoa were detected by Casper in stains upon his shirt.

In addition to the other facts mentioned respecting their characters, it may be remarked that they move for many hours out of the body when kept at a temperature of 98°, and they even retain their rapid motions when the spermatic liquid is mixed with water; but these motions cease immediately on the addition of urine or chemical reagents. According to Müller, the spermatozoa may retain vitality (or free motion) in the body of a woman for the period of seven or eight days, and even longer. When this vitality, indicated by free motion, has disappeared, the properties of the seminal fluid are destroyed, and there is reason to believe that it no longer possesses a fecundating power.

The detection of dead or motionless spermatozoa in stains may be made at long periods after emission, when the fluid has been allowed to dry. In three cases, at intervals of from one week to seven weeks after the perpetration of the crime, Casper was enabled to demonstrate the presence of spermatozoa on articles of clothing, and thus to furnish strong corroborative evidence. (Op. cit. vol. 2, p. 161.) Dr. Koblanek made experiments on this subject, in reference to different periods of time; he found these bodies distinctly, after three days, one month,—three, four, six, nine, and even twelve months. The number of distinct and perfect bodies diminished according to the length of the period at which the examination was made. Thus, at the end of a year, only two perfect specimens could be perceived; but it may be stated, that the discovery of one distinct and entire body is quite sufficient to justify a medical opinion of the spermatic nature of the stain. (See Fig. 2, p. 1013.) M. Bayard states that he has been able to detect spermatozoa in stains after the long period of six years! ('Man. Prat. de Méd. Lég.' p. 277.)

A medical witness must be prepared to consider the precise value of evidence furnished by the microscope in the examination of stains on the dress of a man accused of rape. A shirt may present stains of blood, urine, mucus, or gonorrhœal discharge, some of which, but for the microscope, might be mistaken for spermatic stains. Admitting that, by the process above described, the microscope enables an examiner to affirm that the stains have really been caused by the spermatic secretion, this does not prove that a rape has been committed, or even that intercourse has been necessarily had with a woman. Such stains may arise from spontaneous natural discharge, or from disease (spermatorrhœa), and therefore in themselves they afford no proof of intercourse. If, from other circumstances in the case, it should be clearly and satisfactorily proved that there has been intercourse, then the presence of blood mixed with the spermatic stains might, in certain cases, justify an opinion that violence had been used. The discovery of spermatic stains on the dress of a woman furnishes stronger evidence of intercourse, attempted or perpetrated, than their discovery on the dress of a man; but admitting that intercourse is thus proved, it may still have taken place with the consent of the woman. These stains, when found on the dress of girls and infants, afford a strong corroborative proof of the perpetration of the crime.

Microscopical evidence from the woman.—It may become necessary to determine, in reference to a woman, whether intercourse has or has not recently taken place. All observers agree that, within a certain period after connection, the fact may be established by the examination of the vaginal mucus. A small quantity of this mucus placed upon glass, and diluted with water, will be found to contain spermatozoa, if the suspicion be correct. M. Bayard states that he has thus detected these bodies in the vaginal mucus of females not subject to morbid discharges, at various intervals up to three days after intercourse (op. cit., p. 277); and Donné found them under similar circumstances in a woman who had been admitted into the hospital the day before (op. cit., p. 305). This evidence may become of value in a charge of rape, but it may be easily destroyed by the presence of leucorrhœa: and it is open to an objection, that, in certain morbid stages of the vaginal mucus of the human female, there is found in it a microscopic animalcule, called by Donné the *Trichomonas vaginæ*. This has a larger body and a shorter tail than the spermatozoon. The annexed illustration shows the form of the trichomonas, as represented by Donné ('Cours de Microscopie,' Planche IX.). The engraving illustrates the microscopical appearance of vaginal mucus: *a a*, pus-globules: *b b*, trichomonas: the large irregular body in the centre of the engraving is an epithelial scale. Other substances may be sometimes found in the vaginal mucus; see case by Dr. Lender (Horn's 'Vierteljahrschrift,' April 1865, p. 355).

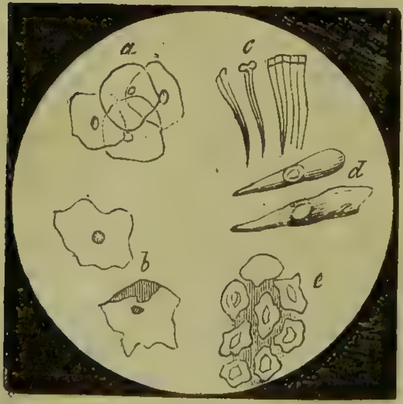


Pus-globules with Trichomonas.

Marks of blood on clothing.—Marks of blood upon the linen can, of course, furnish no evidence unless taken with other circumstances. The linen may be intentionally spotted or stained with blood for the purpose of giving apparent support to a false accusation. Dr. Bayard met with a case of this kind, in which a woman charged a youth with having committed a rape upon her infant child. On examination, the sexual organs were found uninjured; and on inspecting the marks of blood on the clothes of the child, it was observed that the stains had been produced on the *outside*, and bore the appearance of smearing; the whole fibre of the stuff had not even been completely penetrated by the liquid. These facts established the falsehood of the charge. ('Ann. d'Hyg.' 1847, vol. 2, p. 219.) A case involving a false charge of rape was tried at the Glasgow Autumn Circuit in 1859. One of the witnesses, an accomplice, proved that she had purchased some blood and handed it to the female who made the charge, and she saw her smear it over her person and on some sheets on which it was alleged the rape was perpetrated. The woman (*Boyle*) and her husband, who made this false charge, were convicted of conspiracy.

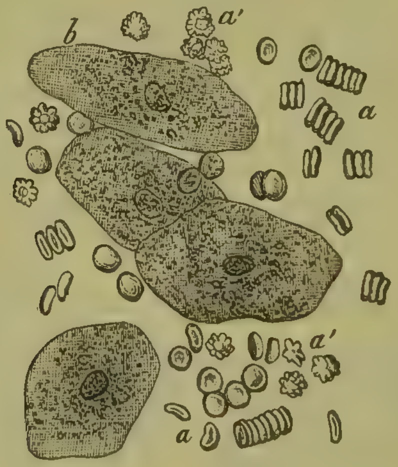
It may be a question whether marks of blood on the linen of a prosecutrix were caused by effusion as a result of *violence* or by the *menstrual discharge.* The menstrual fluid in the normal state is said to be entirely free from fibrin; but in respect to the red colour, the presence of red corpuscles and of serum, the two kinds of blood are similar. That fibrin is frequently present, and in large quantity in the menstrual fluid, is obvious from its being occasionally discharged in a clotted state: hence the discovery of fibrin in a stain would by no means necessarily imply that the blood was from a wound, and not due to menstrual discharge, while its non-discovery would not prove the blood to be menstrual.

FIG. 1.



Varieties of Epithelium (Kirkes).

FIG. 2.



Menstrual blood magnified 450 diameters.

Small quantities of fibrin are not readily separable from linen stained by blood as a result of effusion; and supposing the stain to have been caused by imbibition from another article of dress already stained, the secondary stain would be free from fibrin, which would remain in the stuff originally wetted. A man might thus wrongly pronounce this secondary stain to be due to menstrual blood. The discovery of epithelial scales and mucus, by the microscope, would not prove the stain to be menstrual, unless it could be shown that the mucus was effused with the blood which caused the stain. (See *ante*, p. 794.) The epithelial scales found in the vaginal mucus are of the tesselated variety; they are flat nucleated cells, oval, round, or polygonal in shape, and varying in size. They are spread over the mucous membrane not only of the vagina, but of the mouth, pharynx, œsophagus (gullet), conjunctiva, and the serous and synovial membranes. ('Kirkes' Physiology,' p. 304.) There must be some caution in relying upon this microscopical evidence.

In fig. 1, at p. 1016, *a* represents the scales of tesselated epithelium, *b* the same with the edges folded, *c* cylindrical or columnar epithelium from the stomach, *d* from the jejunum, *e* cylinders as seen when looking at their free extremities. In fig. 2, the microscopical appearance presented by the menstrual discharge is delineated—*a*, blood-corpuscles intermixed with mucous globules: *b*, scales of epithelium.

It may be right to state, for the information of medical practitioners who have hitherto thought that they could easily distinguish menstrual blood, and swear to it, on charges of rape, that a few years since the French Academy of Medicine appointed as a committee MM. Adelon, Moreau, and Le Canu, to examine this question in the most comprehensive manner. These gentlemen reported that, in the present state of science, there is no certain method by which menstrual blood can be distinguished from that effused from the blood-vessels in a case of child-murder or abortion. ('Ann. d'Hyg.' 1846, vol. 1, p. 181; see *ante*, p. 584.)

Evidence of violation in the dead.—The body of a child or woman is found dead, and a medical witness may be required to determine whether her person has or has not been violated before death. There is here some difficulty, because there will be no statement from the prosecutrix herself. The witness can seldom do more than express a conjectural opinion, from the discovery of marks of violence on the person and about the genital organs. Even if spermatozoa were detected in the liquid mucus of the vagina, or on the dress of a female, this would merely prove that there had been intercourse; whether violent or not would depend on the medical and circumstantial evidence. In a case of murder tried at Edinburgh some years ago, the first point to determine in the dead body was, whether a rape had or had not been committed. The examination of the stains on the dress was conclusive, when taken in conjunction with the other evidence. The jury convicted the man of a rape, and yet acquitted him of the murder, although the proof of the latter crime was clearer than that of the rape! (For a case in which evidence was obtained on the examination of a dead body, see Casper's 'Klinische Novellen,' p. 17.)

Rape by females on males.—So far as I can ascertain, this crime is unknown to the English law. Several cases of this kind have, however, come before the French Criminal Courts. In 1845, a female, aged eighteen, was charged with having been guilty of an act of indecency, with violence, on the person of Xavier T., a boy under the age of fifteen years. She was found guilty, and condemned to ten years' imprisonment. In another case, which occurred in 1842, a girl, aged eighteen, was charged with rape on two children,—the one eleven and the other thirteen years of age. It appeared in evidence that the accused enticed the two boys into a field, and there had forcible connection with them. This female was proved to have had a preternatural contraction of the vagina, which prevented intercourse with adult males. She was found to be labouring under syphilitic disease, and the proof of her offence was completed by the disease having been communicated to the two boys. She was condemned by the Court of Assizes of the Seine to fifteen years' hard labour at the galleys. ('Ann. d'Hyg.' 1847, vol. 1, p. 463.) Casper describes cases of this description which have fallen under his observation. ('Handbuch der Gerichtlichen Medicin,' vol. 2, p. 129; and 'Klinische Novellen,' 1863,

p. 15.) By the Penal Code of France, it is a crime in either sex to attempt intercourse with the other, whether with or without violence, when the child is under eleven years of age. That this offence is perpetrated in England cannot be doubted. It is by no means unusual to find, in the wards of hospitals, mere boys affected with the venereal disease. In some instances this may be due to precocious puberty; but in others it can only be ascribed to that unnatural connection of adult females with male children, which is punished as a crime in the other sex. The only accessible medical proof would consist in the transmission of gonorrhœa or syphilis from the woman to the child.

Sodomy. Bestiality.

This crime is defined, the unnatural connection of a man with mankind or with an animal. The evidence required to establish it is the same as in rape, and therefore penetration alone is sufficient to constitute it. There are, however, two exceptions: 1st, it is not necessary to prove the offence to have been committed against the consent of the person upon whom it was perpetrated; and 2ndly, both agent and patient (if consenting) are equally guilty; but the guilty associate is a competent witness. In one case (*Rex* v. *Wiseman*), a man was indicted for having committed this offence with a woman, and a majority of the judges held that this was within the statute. Unless the person is in a state of insensibility, it is not possible to conceive that this offence should be perpetrated on an adult of either sex against his or her will; the slightest resistance would suffice to prevent its perpetration. In August 1849, a question on this point was referred to me from Kingston, Jamaica. A man was convicted, and sentenced to transportation for life, for the crime of sodomy, alleged to have been committed on the complaining party while he was asleep. The only evidence against him was the statement of the complainant. The opinion given was in conformity with that of Dr. J. Ferguson, who referred the case to me—namely, that the perpetration of the act during a state of natural sleep was contrary to all probability. The remarks already made in reference to rape during sleep may be applied with greater force to acts of this nature. (See p. 1007.) If this crime be committed on a boy under fourteen years, it is felony in the agent only; and the same, it appears, as to a girl under twelve. ('Archbold,' p. 409.) The act must be in the part where it is usually committed in the victim or associate of the crime, and if done elsewhere it is not sodomy.

The facts are commonly sufficiently proved without medical evidence, except in the cases of young persons, when marks of physical violence will in general be sufficiently apparent. In some instances, proof of the perpetration of the crime may be obtained by resorting to microscopical evidence. (See Donné, op. cit. p. 305.) Stains upon the linen of young persons may thus furnish evidence that the crime has been attempted, if not actually perpetrated. Trials for sodomy are very frequent; the crime is punishable by penal servitude for life, under the 24th and 25th Vict. c. 100, s. 61. There cannot be the slightest doubt that false charges are more numerous than those of rape, and that they too often prove a successful mode of extortion. This is rather a legal than a medical question; but it is especially deserving of notice, that such accusations are frequently made by soldiers and a bad class of policemen!

INSANITY.

CHAPTER 79.

WHAT IS INSANITY? MEDICAL DEFINITIONS—DISTINCTION OF SANE FROM INSANE PERSONS—MEDICAL RESPONSIBILITY IN REFERENCE TO THE CUSTODY OF THE INSANE—MORAL INSANITY—LEGAL DEFINITIONS—'NON COMPOS MENTIS'—SYMPTOMS OF INCIPIENT INSANITY—HALLUCINATIONS AND ILLUSIONS—LUCID INTERVALS.

What is insanity? Medical definitions.—The terms insanity, lunacy, unsoundness of mind, mental derangement, madness, and mental alienation or aberration, have been indifferently applied to those states of disordered mind in which a person loses the power of regulating his actions and conduct according to the ordinary rules of society. In all cases of real insanity, the intellect is more or less affected—hence the term *intellectual insanity.* In a medical sense this implies a deviation of the mental faculties from an assumed normal or healthy standard. In an insane person there may be no bodily disease, but his language and habits are changed,—the reasoning power which he may have enjoyed in common with others is lost or perverted, and he is no longer fitted to discharge those duties which his social position demands. Further, from perversion of reason, he may show a disposition to commit acts which may endanger his own life or the lives of those around him. It is at this point that the law interferes for his own protection, and for that of society.

Many attempts have been made by psychologists to define insanity: but the definitions hitherto given are so imperfect, that it would be difficult to find one which includes all who are insane, and excludes all who are sane. This difficulty is fully accounted for by the fact that mental disorder varies in its degree as well as in its characters; and the shades of disordered intellect in the early stages are so blended, as to be scarcely distinguishable from a state of sanity. It is this twilight condition of the mind, when it is fluctuating between sanity and insanity, which no definition can comprise, especially as the mind differs in its power and manifestations in most persons, and it is therefore difficult to fix upon a standard by which a fair comparison can be made. The vulgar notion of insanity is, that it consists in an entire deprivation of reason and consciousness; but the slightest acquaintance with the insane proves, that they are not only perfectly conscious of their actions in general, but that they reason upon their feelings and impressions. Locke, indeed, defined a madman to be one 'who reasoned correctly from false premises;' yet we know that not only many sane people do this, but one who is insane often reasons falsely from the objects presented to his senses, or from his own fancies. The late Dr. Abercromby considered insanity to consist in a loss of the faculty of *attention*,—that power by which we are capable of changing, controlling, arresting, or fixing the current of our thoughts. Dr. Conolly regards it as a disorder of the power of *comparison or judgment*, and Professor Marc as a loss of the faculty of *volition*; so that, in the latter point of view, the acts of the insane are all involuntary, and depend upon impulses which they cannot control.

These definitions are defective, inasmuch as they are not adapted to the various forms of the disease. In some cases of insanity, as in confirmed idiocy, there is no evidence of any exercise of the intellectual faculties; but in most instances these faculties and the moral feelings are partially diseased, or partially destroyed, in every variety and degree. Thus we may meet with cases in which the faculties of attention, comparison, and volition are more or less impaired or absent, or, if present, they are never perfect, although each may not be equally affected. When no two cases are precisely similar, no definition can include all varieties of the disorder. A medical witness who ventures upon a definition, will generally find himself involved in numerous inconsistencies; no words can possibly comprise the variable characters which this malady is liable to assume. The power which is most manifestly deficient in the insane is, generally, the controlling power of the will. There are, however, cases in which a medical man will find himself compelled, if not to define insanity, at least to show some clear distinction between a sane and insane person. In *Reg.* v. *Leander* (Cent. Crim. Court, June 1864), the defendant, a lady, was indicted for a misdemeanour, in receiving into her house two or more lunatics; the house not being licensed or registered to receive lunatics, under the provisions of the 8th and 9th Vict., c. 100, s. 44. Under this statute no person is allowed to receive more than one lunatic into his house, unless the house is an asylum, and registered or licensed for the reception of lunatics. The medical evidence showed that there were eighty persons, chiefly females, who were inmates of this house; and five of these, who were visited and examined by a physician of experience in insanity, were pronounced by him to be decidedly of *unsound mind*. In one there was a total loss of memory, another was a confirmed idiot, and a third was labouring under mania with excitement. The medical witness was strongly pressed in cross-examination to define insanity. He said that it was difficult to draw the distinction between weakness of intellect and unsoundness of mind, and that there was no definite line between a low state of intellect and idiocy, so that it was impossible to say where the one ended and the other began; still he was satisfied that these were cases of insanity, such as would be ordinarily received into a lunatic asylum. One of the ladies was subject to delusions, and this he considered to be a proof of unsoundness of mind. The defence rested chiefly on the suggestion that there were many sane persons whose intellects were dull, —whose memories were weakened, especially when suffering from epilepsy, and who, without being insane or lunatic, were incapable of taking care of themselves; upon this the jury were asked to believe that the ladies in the house of defendant were sane. As this suggestion was directly opposed to the medical opinion given, an attempt was made to overthrow the evidence by the statement that 'the world knew what fancies and theories medical men had on the subject of insanity;' and, whereas the certificates of two were required before a person could be confined as a lunatic, only one had been called in this case. The learned judge (Bramwell, B.), in charging the jury, said that 'they must be satisfied from the evidence that these were cases of *insanity*. Although medical men were often heard in Courts of Justice to define insanity, he thought ordinary men of the world were just as well qualified to form an opinion on these matters as they were.' The defendant was convicted; the jury probably thinking that if these persons were not really insane, there would have been no want of medical evidence to prove their sanity on the part of the defence.

Another case occurred at the Central Criminal Court, in September 1864 (*Regina* v. *Wilkins*), in which a medical man was indicted under another section of the same statute, which enacts that no person (unless he derives no profit from the charge, or a committee appointed by the Lord Chancellor), shall receive to board or lodge, in any house not licensed, any *one* patient, or a lunatic or alleged lunatic, without the usual order and medical certificates as required for lunatic asylums. From the evidence it appeared that defendant had taken charge of a young lady as a boarder; she was found by the police wandering at midnight; she gave the address of the defendant, but no satisfactory account of herself. When examined by medical men she was pronounced to be of unsound mind. The father, who had placed her with the defendant about two years before this occurrence, stated that she was excitable, but not of unsound mind. A physician, who received her after she had strayed from the defendant's house, deposed that she was then in a state of advanced imbecility verging on idiocy. In defence it was alleged that this person was only a nervous and excitable female; that she was not insane or of unsound mind when the defendant first received her as a boarder, even if she had become so subsequently; that she lived with the family, and no restraint was placed upon her. General evidence was called to show that she was merely childish,—of weak mind, and very timid; that she could talk rationally, but in a childish manner. All agreed that her mind was feeble. Of two medical gentlemen called for the defence, one said that latterly her mind had become somewhat unsound, and was not so vigorous as at first. Before the night on which she escaped, and on which she was found wandering by the police, there was not in his opinion such unsoundness of mind as would have justified her confinement; and the other deposed that when he saw her two or three months since, he considered her to be capable of taking care of herself, although incompetent to manage her affairs, and that she required medical superintendence but not the restraint of a lunatic asylum. This brought a question from the judge, whether he then thought that the fact of her wandering about the Edgware Road in the dead hour of the night was a proof of her being able to take care of herself. The jury found the defendant 'guilty.' There could be no doubt that this young lady was of unsound mind in the sense intended by the law: she may not have been so when first received, but the act includes all cases in which insanity comes on after the reception of the person. The certificates given by independent medical men in this case were to the effect that she talked incoherently to herself, repeating the words 'next of kin' without being able to explain why, that she was quite unable to maintain a conversation, and that she was suffering imbecility in the first degree. This, together with the fact of her being found wandering at night under circumstances in which no young lady in her social position would be found, should have sufficed to prevent any difference of opinion among medical witnesses respecting the existence of unsoundness of mind in this person.

It is in such cases as these that a medical definition of insanity becomes of legal importance, and a medical expert must be prepared to say whether the person concerning whom the question is raised is idiotic, lunatic, or of unsound mind, and to assign sufficient reasons for his opinion.

Moral insanity.—In addition to that form of insanity in which the mind is affected, known as *intellectual insanity*, Dr. Prichard and other medico-legal writers have described a state which they call *moral insanity* (*Mania sine delirio*), which is manifested simply by a perverted or disordered state of the feelings, passions, and emotions, irrespective of any apparent intellectual aberration. There are no hallucinations or illusions, and there is no evidence of delusion, but simply a perversion of the moral sentiments. Thus it is alleged that this form of insanity may appear in the shape of a causeless suspicion, jealousy, or hatred of others, especially of those to whom the affected person ought to be attached; and it may also manifest itself under the form of a wild, reckless, and cruel disposition towards mankind in general. It does not seem probable, however, that moral insanity, as thus defined, ever exists or can exist in any person without greater or less disturbance of the intellectual faculties. The mental powers are rarely disordered without the moral feelings partaking of this disorder: and, conversely, it is not to be expected that the moral feelings should become to any extent perverted without the intellect being affected, for perversion of moral feeling is generally observed to be one of the early symptoms of disordered reason. The intellectual disturbance may be sometimes difficult of detection; but in every case of true insanity it is more or less present, and it would be a highly dangerous practice to pronounce a person insane, when some evidence of its existence was not forthcoming. The law does not recognize moral insanity as an independent state; hence, however perverted the affections, moral feelings, or sentiments may be, a medical jurist must always look for some indications of disturbed reason. Medically speaking, there are, according to Dr. Prichard, two forms of insanity, moral and intellectual: but in law there is only one,—that which affects the mind. Moral insanity is not admitted as a bar to responsibility for civil or criminal acts, except in so far as it may be accompanied by *intellectual* disturbance. Dr. Mayo denies its existence, and contends that no abnormal state of mind should confer irresponsibility unless it involves intellectual as well as moral perversion. ('Medical Testimony,' p. 69.) The late Sir B. Brodie also considered that there are no reasonable grounds for admitting this to be an independent form of insanity. There has been, as he suggests, much mystification on the subject. The term has been applied to cases in which the name of insanity ought not to have been applied at all, *i.e.* to 'moral depravity,' and also to cases in which delusions have really existed, and which might therefore have been more properly classed with cases of ordinary mental aberration. ('Psychological Inquiries,' p. 99.) Of one fact we may be well assured: if in these cases of alleged *moral* insanity there is no indication of a perversion of intellect, *medical* evidence is not required to determine the fact or the degree of responsibility in reference to these persons. Those who administer the law, and any man endowed with plain common-sense, will be as well qualified as a medical expert to decide the question of criminal responsibility. Further, until medical men can produce a clear and well-defined distinction between moral depravity and moral insanity, such a doctrine, employed as it has been for the exculpation of persons charged with crime, should be rejected as inadmissible.

Legal definitions.—The law of England recognizes two states of mental disorder or alienation: 1. *Dementia naturalis*, corresponding to idiocy; and 2. *Dementia adventitia*, or *accidentalis*, signifying general insanity as it occurs in persons who have once enjoyed reasoning power. To this state the term lunacy is also applied, from an influence formerly supposed to be exercised on the mind by the moon. *Lunacy* is a term generally applied to those disordered states of mind which are known to medical men under the names of mania, monomania, and dementia; and which are frequently, although not necessarily, accompanied by lucid intervals. The main character of insanity, in a legal view, is considered to be the existence of *delusion*—*i.e.* that a person should believe something to exist which does not exist, and that he should act upon this belief. Many persons may labour under harmless delusions, and still be fitted for their social duties; but should these delusions be such as to lead them to injure themselves or others in person or property, then the case is considered to require legal interference.

Besides the terms *Idiocy* and *Lunacy*, we find another frequently employed in legal proceedings, namely, '*unsoundness of mind*'—(*non compos mentis*)—of the exact meaning of which it is impossible to give a consistent definition. From various legal decisions, it would appear that the test for unsoundness of mind in law has no immediate reference to the existence of delusion in the mind of a person, so much as to proof of incapacity from some morbid condition of intellect to manage his affairs with ordinary care and propriety. (Amos.) Neither condition will suffice to establish unsoundness without the other: for the intellect may be in a morbid state, and yet there may be no legal incompetency; or the incompetency alone may exist and depend on bodily infirmity or want of education—conditions which must not be confounded with mental disorder. Thus, then, a person may be of unsound mind, *i.e.* legally incompetent to the control of his property, and yet not come up to the strict legal standard of lunacy or idiocy.

Some medical practitioners have attempted to draw a distinction between *insanity* and *unsoundness* of mind. A case occurred in 1839, in which a medical man hesitated to sign a certificate for the confinement of an alleged lunatic, because in it the words 'unsound mind' were used. He said he would not have hesitated to sign it had the term 'insane' been employed. The difference, if any exist, is purely arbitrary, and depends on the fact that 'unsound mind' is a legal and not a medical phrase, referring to an incapacity to manage affairs, which insanity, in its most enlarged sense, does not always imply. The law, however, appears to admit some sort of distinction: for, according to Chitty, it is a criminal and an indictable act maliciously to publish that any person is afflicted with insanity, since it imputes to him a malady generally inducing mankind to shun his society; although it is not libellous to say that a man is not of sound mind, because no one is of perfectly sound mind but the Deity! ('Med. Jur.' vol. 1, p. 351.) In reference to the signing of certificates of insanity, it is, however, an error to suppose that the use of one term can involve any practitioner in a greater share of responsibility than the use of the other.

If on a commission of lunacy a medical witness states that he believes a person to be of unsound mind, he should be prepared to assign good and valid reasons for this belief, as well as what he intends by unsoundness of mind. Questions on these points are generally put by opposing counsel.

Symptoms of incipient insanity.—The symptoms by which insanity is indicated at an early stage are liable to great variation, according to the sex, age, and social position of the person. In reference to suicide, the execution of wills, or the perpetration of crime, we often find after the death of the person, or at the trial which follows the crime, that the most trivial and irrelevant circumstances are brought forward as indications of insanity. This subject has been ably treated by Dr. Forbes Winslow ('Obscure Diseases of the Brain,' p. 88), and to his work I must refer the reader for much useful information. The facts are there gathered chiefly from the accounts furnished to him by those who have recovered. There is great irritability at the most trifling circumstances—impatience of contradiction, loquacity, great difficulty in directing attention to, and steadily occupying the mind with any train of thought, neglect of usual employment, sleeplessness, depression of spirits without reasonable cause, a disposition to seclusion, doubts about personal identity, followed by hallucinations and illusions. A lady, who was gradually affected, remained insane for nearly eleven months: she informed Dr. Winslow that during the whole of that time she fancied she was in hell and tormented by evil spirits; she thought every person near her was the devil. Sometimes a patient fancies he is continually watched by spies, that policemen are looking after him, and that conspiracies and plots among his relatives or friends are going on secretly against him; he believes that his food is drugged or poisoned, and will refuse to eat. Great anxiety on any subject followed by headache may be the forerunners of an attack; there is generally an entire loss of interest in the usual occupations, a silent manner, and a great desire for solitude. In one instance, fits of immoderate laughter at the most trivial occurrences preceded the attack. Sooner or later these symptoms are attended by perverted taste or smell—by illusions of hearing or sight; voices are heard, and objects are seen, which at first perplex and then confuse the patient; they continue until he feels overpowered mentally and bodily; and he then falls into delusions regarding himself, his friends who are about him, his profession or occupation, and his worldly circumstances.

Hallucinations and Illusions.—These are the most striking symptoms which are met with in a confirmed state of insanity. Hallucinations are those sensations which are supposed by the patient to be produced by external impressions, although no material objects act upon his senses at the time: illusions, on the other hand, are sensations produced by a false perception of objects. A man has visions of all kinds, including the forms of the dead and the living, floating before him, when he is gazing upon vacancy. He fancies he hears voices speaking or mysteriously whispering to him, while there is profound silence,—these are hallucinations. Another may erroneously imagine that the taste or smell of his ordinary food is earthy, metallic or poisonous—when the perversion is in his own senses—these are illusions. Both conditions depend upon a disordered state of the mind. Instances of hallucination are furnished by the act of dreaming: while illusions occur often during the act of suddenly waking from sleep—giving rise occasionally to serious questions involving criminal responsibility. The state of insanity is in other points of view analogous to dreaming. There is equally a want of power in the two states to change or control the current of thought passing through the mind. Things which are impossible and inconsistent, are believed to have an actual existence. A voice heard during the act of dreaming sometimes becomes an illusion connected with a current of thought then passing through the mind; it is the same in a case of confirmed insanity, with this difference in the latter, that some power of will or some exercise of reason may still exist.

Although a person may labour under hallucinations without any mental disorder independently of that requisite for their production, yet they may give rise to insane ideas; and, on the other hand, insane ideas will often produce hallucinations. Hallucinations and illusions frequently coexist in insanity; but in two-thirds of all cases the hallucinations are confined to the sense of hearing. Voices calling to the person from the corners of his room, and directing him to do certain acts, are heard where none exist, and the illusion is displayed in a voice being heard differently from what it is: a harsh and grating noise may be thus mistaken for the finest musical sounds. So with the sense of feeling; the folds in the sheet of a bed on which an insane person is lying, may be mistaken for hot coals, or bundles of serpents, and sometimes nothing but force will compel the patient to sleep in a bed; if permitted, he will get out and prefer sleeping on the floor. It is questionable how far force is justifiable under these circumstances, when the health of a person is not likely to suffer by his apparently irrational conduct. His illusion is not cured, but strengthened; such treatment frequently brings on a violent fit of maniacal excitement. Hallucinations occasionally exist in persons who are sane, but whose health is disordered, and then we generally find them connected with the sense of vision.

The illusions of the insane are sometimes of a remarkable nature. Thus, an object may be seen by them, but in size and shape it may be subject to continual changes. The Hon. Mr. Perceval, in reference to his own condition, mentions that on the commencement of his insanity, while looking at a boiled fowl, which was prepared for his dinner, it appeared very large and plump, then it suddenly became small and meagre, and afterwards of twice its former size. So in watching a fellow-patient, who was one day walking in the airing-ground, he observed at one part of the walk that this man suddenly changed in shape, and walked into the house under the form of a demon. ('Personal Narrative,' p. 81, 1838.) The illusion from the same object is therefore not always fixed and permanent, but subject to momentary changes. Illusions do not merely proceed from impressions produced on the external senses; they often arise from internal sensations; in other words, they are subjective, and give rise to strange fancies, and singular and perverted ideas. A man confined in an asylum labouring under disease of the lungs, protested to me that he felt the fires of hell burning within his chest. To the same class of disordered impressions among lunatics may be referred the feeling of insects crawling over the skin,—of the flesh being gnawed from the bones, or of their bodies being cut and torn to pieces. Illusions are sometimes met with in the sane, but when arising from external objects, the false perception is soon corrected by a reference to the other senses; and herein consists the main difference between sanity and insanity—namely, *delusion*, or a misleading of the mind. When the hallucination or illusion is believed to have a positive existence, and that belief is not removed either by reflection or an appeal to the other senses, the person is insane; but when the false sensation is immediately detected by the judgment, and is not acted on as if it were real, then the person is sane. *Delusion*, therefore, properly refers to the judgment, and *illusion* to the senses. The meaning of these terms is often confounded; but while delusion is always connected with insanity, illusion is not necessarily indicative of mental disorder.

Hallucinations and illusions are the main features of those forms of insanity which are known as mania and monomania. They are rarely met with in cases of idiocy and imbecility, sometimes in dementia, but they are most common in paroxysms of mania. Acts of murder may generally be traced to their existence, for the person labouring under mania or monomania is unable during a paroxysm to divest his mind of the belief that what he sees has a positive existence before him. He feels impelled to suicide by the hallucination of voices calling to him, and to murder by the illusion that he is not destroying a wife, child, or friend, but an evil spirit substituted for them.

The acts of the insane are generally connected with their delusions, although it is not easy to trace the connection except by their own admissions. When the acts are unusual and strange, it is most probable that they depend on hallucination, illusion, or both. M. Marc mentions the case of a man who for many years had been in the habit of licking the bare walls of his apartment with his tongue, and apparently with the greatest relish. No one could imagine what was the cause of this patient's perseverance in so painful and disgusting a habit—for in many parts he had actually worn away the plaster—when one day M. Marc was upbraiding him on the subject, and he then confessed that he fancied he was tasting and smelling the most delicious fruit. ('De la Folie,' vol. 1, p. 195.)

It is important to observe that, although some who labour under insanity are aware of their condition and lament it, this is chiefly confined to incipient and convalescent cases. In general, they are not in the least conscious of their situation, but affirm that they are in better health and spirits than usual, and in the possession of a perfect mind. Those who have been depressed prior to the attack will become cheerful afterwards, and *vice versâ*. The Hon. Mr. Perceval, whose first evident delusion was that of mistaking a red silk handkerchief for one saturated with blood, thus describes the commencement of his attack:—'Whilst thus reflecting (referring to some religious views which had troubled his mind), a new and wonderful sensation came upon me from my head downwards, through my whole frame. I felt a spirit or a humour shedding its benign influence, the effect of which was that of the most cheerful, mild, and grateful peace and quiet.' ('Personal Narrative,' p. 21.) This description coincides with general observation. There can be no greater mistake than to suppose that what to ourselves is an obvious delusion, is a delusion to the insane. No insane patient was ever yet convinced by any sort of reasoning that he saw things falsely, or judged of them incorrectly; hence it would be just as absurd to try to reason him out of his belief, as it would be to try to reason a sane person out of his belief of what was real and true. (Pagan, Op. cit. p. 26.)

Some have supposed that there is a loss of memory in the insane—that they have not the power of remembering what took place during their insanity, or recalling their sensations. This may be the case in some instances, but it is certainly not so in all; and no general rule can be laid down on the subject. The Hon. Mr. Perceval appears to have retained an acute remembrance of his attack, and his condition while it lasted. He published his 'Narrative' on his recovery; in this, the most minute circumstances are recorded.

Lucid intervals.—By a lucid interval, we are to understand in a legal sense, a temporary cessation of the insanity, or a perfect restoration to reason. This state differs entirely from a remission, in which there is a mere abatement of the symptoms. It has been said that a lucid interval is only a more perfect remission, and that although the lunatic may act rationally and talk coherently, yet his brain is in an excitable state, and he labours under a greater disposition to a fresh attack of insanity than one whose mind has never been affected. Of this there can be no doubt, but the same reasoning would tend to show that insanity is never cured; for the predisposition to an attack is undoubtedly greater in a recovered lunatic than in one who is and has always been perfectly sane. Even admitting the correctness of this reasoning, it cannot be denied that lunatics do occasionally recover for a longer or shorter period, to such a degree as to render them perfectly conscious of and legally responsible for their actions like other persons. The law intends no more than this by a lucid interval: it does not require proof that the cure is so complete that even the predisposition to the disease is entirely extirpated. Such proof, if it could even be procured, would be totally irrelevant. If a man acts rationally and talks coherently, we can have no better proof of a restoration to reason. If no delusion affecting his conduct remain in his mind, we need not concern ourselves about the degree of latent predisposition to a fresh attack which may still exist.

Lucid intervals sometimes appear suddenly in the insane: the person feels as if awakened from a dream, and there is often a perfect consciousness of the absurdity of the delusion under which he was previously labouring. The duration of the interval is uncertain; it may last for a few minutes only, or may be protracted for days, weeks, months, and even years. In a medico-legal view, its alleged existence must be always looked upon with suspicion and doubt when the interval is very short. These lucid intervals are most frequently seen in cases of mania and monomania; they occasionally exist in dementia when this state is not chronic, but has succeeded a fit of intermittent or periodical mania. They are never met with in cases of idiocy and imbecility. It is sometimes a matter of great importance to be able to show whether or not there exists or has existed a lucid interval, since, in this state, the acts of a person are deemed valid in law. The mind should be tested, as in determining whether the patient is labouring under insanity or not. He should be able to describe his feelings, and talk of the subject of his delusion, without betraying any signs of unnecessary vehemence or excitement. It may happen that a person who is the subject of a Commission of Inquiry is at the time of examination under a lucid interval, in which case there may be some difficulty in forming an opinion of the existence of insanity. This occurred in the case of *Lady Seymour* (July 1838): when examined before a Commission, her replies were so rational and collected that no verdict could be given, and the case was adjourned. When the inquiry was resumed, it was satisfactorily proved that she was insane, not merely by general and medical evidence, but by the terms of her will, which had been drawn up by herself. The same circumstance happened in the cases of *Mrs. Hartley* and *Mr. Pearce*, who were the subjects of Commissions in 1843. It has been said that a person in a lucid interval is held by law to be responsible for his acts, whether these be of a civil or criminal nature. In regard to criminal offences committed during a lucid interval, it is the opinion of some medical jurists that no person should be convicted under such circumstances, because there is a probability that he might at the time have been under the influence of that degree of cerebral irritation that renders a man insane. (Prichard.) This remark applies especially to those instances in which the lucid interval is very short. Juries now very seldom convict, however rationally in appearance a crime may have been perpetrated, when it is clearly proved that the accused was really insane within a short period of the time of its perpetration.

CHAPTER 80.

VARIETIES OF INSANITY—MANIA—DEMONOMANIA—PANOPHOBIA—EFFECT OF COLD ON MANIACS—ABSTINENCE FROM FOOD—DELUSIONS REGARDING POISON—DELIRIUM DISTINGUISHED FROM MANIA—MONOMANIA—ILLUSIONS AND DELUSIONS—ECCENTRICITY—SUICIDAL MANIA—IS SUICIDE A PROOF OF INSANITY?

Varieties of insanity.—Medical jurists have commonly recognized four distinct forms of insanity: *Mania*, *Monomania*, *Dementia*, and *Idiocy* (*Amentia*). This division was proposed by Esquirol, and although of a purely artificial nature, it is highly convenient for the arrangement and classification of the facts connected with the subject. In some instances there is great difficulty in assigning a particular case to either of these divisions, which is owing to the circumstance, that these states of disordered mind, if we except idiocy, are frequently intermixed, and are apt to pass and repass into each other. On other occasions a case may represent mixed characters which appertain to all the divisions. Some psychologists have proposed two subdivisions,—namely, *Incoherency* and *Imbecility*; but the former is merely a mixed state of mania and dementia, while the latter is a term applied to those cases of idiocy wherein the mental faculties are susceptible of some degree of cultivation after birth, without reaching the normal standard.

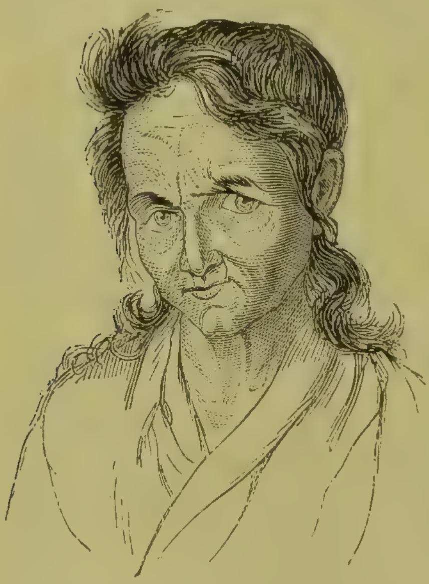
MANIA.

In this form of insanity there is a general derangement or perversion of the mental faculties, accompanied by greater or less excitement, sometimes amounting to violent fury. (Pagan's 'Med. Jur. of Insanity,' p. 59; Marc. 'De la Folie,' vol. 1, p. 211.) Ideas flow through the mind without order or connection, the person losing all control over his thoughts, and believing and acting upon them, however absurd and inconsistent they may be. Rapidity of utterance and incessant agitation accompany this state; there is also great irritability, so that not the least contradiction can be borne. Mania may take place suddenly, as after a violent moral shock, but in general it comes on slowly. It may be chronic or acute, recurrent, or continued. There are very few cases which do not present remissions, more or less complete; and in some instances after a violent attack, the reason appears to be perfectly restored, forming then what is termed a lucid interval, the clear distinction of which, in a legal point of view, is of material importance.

A person afflicted with mania experiences in an early stage hallucinations and illusions; sometimes these are of a pleasant character; as a hunter will fancy that he is pursuing the stag, that he plainly hears the sound of the horn and the baying of dogs. In other instances the voices of demons are continually heard, and their forms are constantly seen. This state is called *demonomania*. An animal, or a particular person hated by the patient, will take on the form of the devil, and no reasoning, or close inspection, will suffice to dissipate this dreadful illusion. The look and language of demonomaniacs are those of the most extreme despair: the devil is either always present before their eyes, or visits them occasionally; and during the darkness of night when they believe these visits to be made, they may be heard talking, howling vociferously, resisting and struggling, as if they were really engaged in a mortal conflict; they complain that the fires of hell are burning within them, and that God has wholly forsaken them. This form of mania has sometimes made its appearance at once as a result of a severe moral shock, and persons affected with it are very apt to commit suicide or murder. When the idea of an evil spirit is fixed and permanent, demonomania is rather a variety of monomania than of mania; most writers place it under the head of monomania, but where this alternates with other delusions, it is a form of insanity which belongs to mania. Murder perpetrated in a fit of insanity may be frequently traced to delusions connected with the devil.

The annexed illustration (fig. 1) represents a patient of Esquirol's, affected with this form of mania. Her life was misery to herself and others. Her delusion was that she was the wife of the devil, and had been so for a million years,—that he was always present before her, and persuaded her to commit the most atrocious crimes. Her body was in incessant motion, and she sought for any opportunity to injure others, even to the destruction of life. (Esquirol, 'Maladies Mentales,' vol. 1, p. 498.)

Fig. 1.



Portrait of a woman affected with demonomania. (Esquirol.)

A person affected with mania sometimes has a dread or fear of everything around him; he cowers down, tries to conceal himself, and shudders at the approach of anyone. This state has been called *panophobia.*

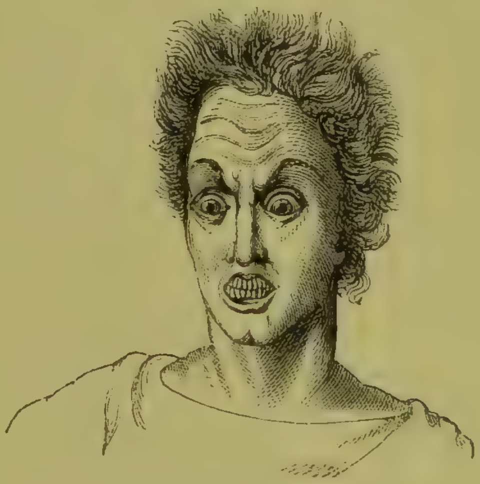
There is a popular notion, that violent fury is met with in all cases of mania; but this is an error. In some instances, as in those just referred to (panophobia), this symptom is wanting. These persons are seldom excited to any acts of violence, andshould they give way to passion, they are easily subdued by the slightest menace.

In the greater number of cases of mania there is excitement, coming on in paroxysms without any obvious cause, and leading the patients to acts of violence either towards themselves or others. These are the instances which chiefly require close personal restraint; this, however, has a tendency to increase the severity of the fit, and a more simple plan of treatment, *i.e.* of watching by personal attendants, has been generally adopted. The fits of violence sometimes come on in a sudden and unexpected manner. On the occasion of a visit which I made to an asylum, a female patient who had been for some time remarkably quiet in her manner, and was considered so far convalescent as to be about to leave the place, seized a living rabbit and tore it to pieces, limb from limb; had she had the opportunity she would have probably done the same with a child. Her mania had suddenly returned, and it was necessary to place her again in confinement.

In visiting a person said to be affected with mania, for the purpose of examination, a medical practitioner cannot be too cautious. The fire-irons and all other articles which may be used as weapons of offence should be removed. The late Dr. Armstrong was accustomed to relate in his lectures, that on one occasion in examining a patient he narrowly escaped with his life. The examination had for some time been conducted quietly, and without any appearance of excitement on the part of the patient, when the man suddenly seized a poker, and aimed a heavy blow at the physician. Fortunately he missed his aim, and assistance was at hand, or Dr. Armstrong might have fallen a victim to the maniac's violence. Mr. Vance, a London medical practitioner, lost his life in consequence of the carelessness and neglect of the attendants. He was sent for to visit a patient suffering under an attack of mania, and just as he had reached the top-stair, the maniac rushed out of his room and precipitated Mr. Vance headlong to the bottom of the stairs: he died soon afterwards. A calm and quiet manner is very apt to allay the suspicion of a medical attendant, and thus furnish the maniac with the opportunity of doing injury which he seeks. On one occasion, in accompanying Dr. Esquirol round the Lunatic Asylum of Charenton, near Paris, I was suddenly seized from behind by a tight grasp round my neck, by which I was rendered powerless, and felt almost strangled (garotted). Dr. Esquirol and other physicians, who had gone forward, on hearing the wild shriek of my assailant turned back, and rescued me from a somewhat perilous position. One of the female patients who a few minutes before had been seen by the physician, and had presented nothing but a calm appearance and manner, had silently crept behind me, being the last of the party, and had suddenly thrown both her arms round my neck, apparently with a view of throttling me. These persons are overawed by numbers, but they have the cunning to measure their strength with one person, and to take any advantage for making an attack on him. The restless eye, the stooping gait, the incessant incoherent talking, and the quick and excited manner characteristic of mania, are not always met with in those patients who are most disposed to acts of violence; on the contrary, we can never be more on our guard then in the cases in which we may think precautions are least required.

The countenance is much altered during a paroxysm of mania; the eyes are in constant motion, injected, sparkling, and prominent; the eyebrows are raised,—the hair is erect,—the features are contracted,—the look is vague, except in a fit, when it is menacing. The annexed engraving (fig. 2), taken from an illustration by Esquirol (' Maladies Mentales,' vol. 2, page 162), portrays the aspect of a woman in a violent fit of mania, while placed under bodily restraint. The features show not only intellectual disorder, but great fury; so altered is the countenance by the fit of mania, that the sex is not distinguishable. During an intermission,—on the access of a lucid interval or on recovery, the features are so changed that the person could be no longer recognized as one and the same. Figs. 3 and 4 (p. 1030), also taken from the illustrations of insanity published by Esquirol (Op. cit. vol. 2, p. 165), are well calculated to show the difference presented by the same countenance in a fit of a mania and during a lucid interval. The contrast in physiognomy is well marked in reference to the state of the intellect: in fig. 3 violent rage, fierceness, and anger are strongly displayed in the features; while in fig. 4 they are calm and composed, with that slight shade of melancholy over them which, as Esquirol remarks, is so commonly seen after a fit of mania.

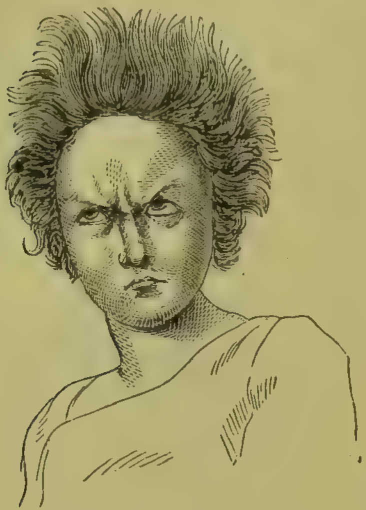
Fig. 2.



Portrait of a woman in a fit of mania.

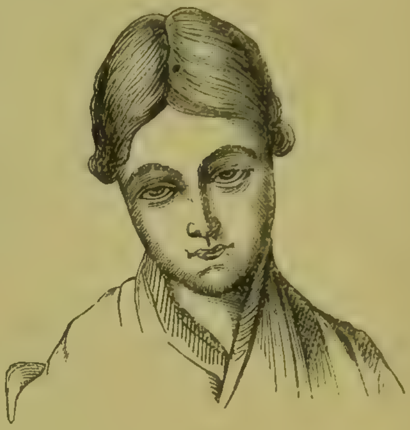
In mania the patient sleeps but little, and sleep is disturbed by painful dreams. There is sometimes more maniacal excitement by night than by day, and this is especially the case during moonlight nights, owing to the stimulus of light, which adds to the restlessness of the patients. This increased restlessness has given rise to the popular notion of the malady being influenced by the changes of the moon, from which the term lunacy (*luna*) as well as the word mania (μήνη the moon) is derived.

FIG. 3.



Aspect of a girl in a fit of mania.

FIG. 4.



The same on recovery (lucid interval).

It has been remarked that in mania there is great insensibility to cold and heat. Some persons affected with this form of insanity have lost their sensibility to such a degree, that they will, if permitted, lie without any covering on a cold stone floor in the midst of winter, or they will handle red-hot coals without any expression of pain; in this case there is usually paralysis. This blunted sensibility is not, however, universal; and we must be careful not to draw from it the inference which has been erroneously drawn on some occasions, in which the death of lunatics in asylums has been a subject of judicial inquiry, —namely, that these persons are less susceptible than sane people of the injurious effects of cold. Their bodily susceptibility is probably just as great, while they want that warning power which the sense of feeling gives to a sane person. The death of a lunatic of the name of *Dolley* at the Surrey Lunatic Asylum, in March 1856, was ascribed to the effects of a cold shower-bath, continued for an unusual period. This case involved a serious question respecting the medical treatment of the insane. The patient, æt. 65, was exposed to a shower-bath for half an hour, at a temperature of 45°; and after removal from this, a full dose of tartar-emetic was given to him. The man died in about a quarter of an hour, and a coroner's jury returned a verdict to the effect that death was caused by this maltreatment. The Grand Jury however threw out the bill, and *Mr. Snape*, the medical gentleman implicated, was exonerated by a medical committee and subsequently reinstated in his office. The treatment was in this case adopted *bonâ fide*, but, nevertheless, if frequently carried out to the same extent, it would expose the lives of aged lunatics to great risk.

Maniacs in some cases are not so susceptible of pain from local injuries as those who are sane. Mr. Abernethy was accustomed to relate in his surgical lectures a singular case illustrative of this statement. A maniac who had been violently exerting himself met with a severe compound fracture of the leg. He was put to bed, the bones were replaced, and all the requisite apparatus carefully adjusted by the medical attendants. The maniac, who had watched the operation, soon after their departure and during the absence of his attendant, removed the splints from the fractured leg and applied them with great skill and nicety to the sound member, concealing the broken leg in a hole which he made for that purpose in the mattrass. At the next visit the surgeon expressed himself satisfied with the manner in which things were going on—stating to the friends that it was impossible the leg could be more straight, or fixed in a better position than that in which it then was. In a day or two symptoms of great constitutional disturbance appeared, and while the surgeons were standing round the bed, and were proposing to remove the splints, the insane patient, to their great astonishment, suddenly drew the fractured leg out of the hole in which he had concealed it, and held it up before them. Its appearance, surgically speaking, was anything but satisfactory. According to Mr. Abernethy, the leg was curved, the bones were displaced, and the wound was filled with a tuft of feathers. Notwithstanding the inflamed state in which it was found, the patient had not expressed any feeling of pain, and it was this perfect tranquillity on his part which had prevented any suspicion arising in the mind of his attendant.

The comparative insensibility of the insane to severe injuries may also give rise to medico-legal questions. This loss of sensibility has been especially noticed where paralysis is associated with the mental disorder. Cases of this kind have been recorded by Esquirol and other writers on Insanity. In *Reg.* v. *Slater and Vivian* for manslaughter (C. C. C. Sept. 1860) the evidence for the prosecution showed that deceased, a lunatic suffering from incipient general paralysis, died rather suddenly three days after a serious struggle with one of his attendants. There were a few slight marks of bruises on the right side of the neck and face, and there was a bruise on the abdomen. On inspection, six ribs were found fractured on the right side, and five on the left. The fractures were at a short distance from the cartilage and were unattended with any displacement. In the abdomen there were lacerations of the left lobe of the liver, two inches in length, and a quantity of partially-coagulated blood was effused in the cavity. These injuries were undoubtedly the cause of death, but when were they inflicted? There was no evidence that the deceased had been subjected to any violence except in the struggle with his attendant *three days* before his death. As this was a life-and-death struggle, and great violence must have been used on both sides, it was considered that the cause of these injuries was sufficiently explained, and that death might have arisen from the violence inflicted by the attendant in endeavouring to escape from the attack of the lunatic. At a subsequent period, two of the lunatics confined in the same ward stated that deceased had been maltreated by the two prisoners shortly before death; that they had thrown him upon the ground, pounded his body with their fists, had stamped on him with both feet, and then dragged him along the floor. Mr. Luke, Mr. Partridge, and Mr. Holt gave evidence of opinion to the effect that the injuries found on the body could have been inflicted only a short time before death, and that although lunatics might show an indifference to pain, yet it was impossible for such injuries as these to have been inflicted three days before death without the deceased exhibiting marked symptoms. The fact of so many ribs being broken would have materially affected respiration: his breathing would have been difficult, and would have attracted observation. As no symptoms were observed, they believed that the injuries which were the cause of death had been inflicted not more than two hours before the man died. Mr. Tyerman and Dr. Tucker, medical officers of the asylum, gave evidence to the effect that the injuries might have been inflicted in the violent struggle with the attendant three days before death, and that the deceased might not have exhibited any indication of the injuries during the interval. It was a case of insanity attended with paralysis, and this might have rendered deceased insensible to pain. The jury acquitted the prisoners. (Winslow's 'Medical Critic and Psychological Journal,' No. 1, January 1861, p. 91.) The power to sustain injuries, and to perform acts of volition and locomotion inconsistent with ordinary surgical experience, has been elsewhere noticed (*ante*, p. 508). An insane person may not only have this power like others, but his disorder may increase his insensibility to the effects of violence.

Persons suffering from mania are able to sustain the privation of food for a great length of time without any apparent injury to health. In some instances, owing to a suspicion that the food is poisoned, they decline to take any; it is then necessary to feed them by the stomach-pump. (Winslow's 'Obscure Diseases of the Brain,' p. 71.) This delusion respecting the poisoning of food is very common in the early stages of mania. On several occasions, when the report of a remarkable case of poisoning has excited public attention, I have been consulted by persons in reference to the alleged poisoning of their food. Wine, bread, milk, and other articles have been brought to me for analysis; but although the result has proved the absence of poison, it has not been possible to persuade the patients that poison was not present. The delusion may be sometimes traced to a peculiar taste in the article of food; at others it has only its usual taste, and the suspicion of poisoning is based entirely on a delusion. In nearly all cases of this description, some person is indicated as the poisoner, and small circumstances in reference to the conduct of this person are magnified into proofs of guilt. In one case some flour which had been used for dressing oysters was brought to me by a medical man for analysis: he felt confident, from the symptoms which he suffered, that the substance was strychnia, and that his wife had put it over the oysters in order to poison him! He informed me that he took the opportunity of her leaving the room to collect a little of the supposed poison, which he brought to me very carefully sealed in a paper, with a written statement of the symptoms which followed, among which some of the symptoms of strychnia had been described. On another occasion, this gentleman brought for analysis a pair of stockings, on which he said his wife had rubbed the extract of belladonna in order to make away with him secretly. The stains on the stockings were large iron-moulds, but he said he perceived in them the smell of belladonna, and after he had worn them his pupils became dilated, and he had dryness of the throat with trembling and convulsions of the limbs! He probably took the account of these symptoms from a book on Poisons. A solicitor retired from practice brought to me a copper tea-kettle, which he said was lined with crystallized arsenic, which had been used for poisoning his sister eight years before: he had kept it privately since that date, and was very desirous of having his suspicions confirmed by a chemical analysis. It proved to be nothing more than the common fur of tea-kettles, and consisted of carbonate and sulphate of lime; there was no arsenic. The whole was a delusion, for the circumstances under which his sister had died left no doubt that her death was owing to natural causes. A continual brooding over his lost relative, and a want of mental and bodily occupation, had led to an attack of insanity.

It is necessary that a medical jurist should be able to distinguish *mania* from delirium depending on bodily disease. *Delirium* closely resembles the acute form of mania,—so closely that mistakes have occurred, and persons labouring under it have been improperly ordered into confinement as maniacs. The following are perhaps the best diagnostic differences:—A disordered state of the mind is the first symptom remarked in mania; while delirium is a result of bodily disease, and there is greater febrile excitement in it than in mania. Delirium being a mere symptom attendant on the disease which produces it, exists so long as that disease and no longer; while mania, depending on widely different causes, is persistent. Delirium disappears suddenly, leaving the mind clear; while mania commonly experiences only remissions. (See Pagan's 'Med. Jur. of Insanity,' p. 69.) In delirium there is generally great acuteness of the senses. Inflammation of the brain or its membranes (*phrenitis*) is distinguished from acute mania by the mode of its attack, the presence of severe pain in the head, and excessive sensibility with intolerance of light and sound.

MONOMANIA.

This name is applied to that condition in which the mental alienation is only partial; in other words, it is nothing more than partial insanity. In mania the mind is disordered on all kind of subjects; in monomania the disorder is confined chiefly either to one subject or to one class of subjects. Monomaniacs are infected with false ideas on certain points, of which they cannot divest themselves, and out of which they cannot be reasoned: they start from false principles, but setting this aside, their inferences and deductions from these principles often possess logical accuracy. In every subject not connected with their special delusion, they are like the rest of the world; they talk and reason as justly upon facts as before the access of their malady, but their general deportment, habits, and character are changed. Thus, a miser may become a spendthrift, and a hardworking and industrious mechanic may pass his time in idleness; a man of moral habits will become immoral in conversation and conduct, and an abstemious man may become a drunkard.

The monomania may be so slight that the person will have the power of controlling his thoughts and actions, so as to appear like one who is sane so long as the subject of his delusion is not referred to. He may then betray himself, but these persons have sometimes a great power of self-control, and of concealing from the medical examiner the delusions under which they labour. Dr. Conolly mentions the case of a gentleman whose only delusion was that the Queen of George III. was deeply in love with him, and had privately given him to understand the favourable nature of her sentiments towards him. Although he conducted himself with propriety, yet, according to the custom of those days, an application was made for a Commission of Lunacy. This was issued, but those who were entrusted with the management of his affairs were obliged to call in the assistance of the supposed lunatic, and to treat him as a sane person. ('Indications of Insanity,' p. 408.) There is no doubt that those who are affected with monomania in an early stage, are frequently able to direct their minds with reason and propriety to the performance of their social duties, so long as these do not involve any of the subjects of their delusions. Their power of controlling their thoughts and feelings, and of concealing their delusions, implies a certain consciousness of their condition not usually met with in mania; and it also appears to imply such a power of self-control over their conduct, as to render them equally responsible with a sane person for many of their acts. In a case of confirmed monomania, however, it is not to be supposed that a man is insane upon *one* point only, and sane upon all other subjects. The only admissible view of this disorder is that which was taken by Lord Lyndhurst, in one of his judgments. In monomania, the mind is unsound; not unsound in one point only, and sound in all other respects, but this unsoundness manifests itself principally with reference to some particular object or person. (Prichard.) There is no doubt that all the mental faculties are more or less affected, but the affection is more strikingly manifested in some than in others.

Monomaniacs frequently reason with correctness from false premises. A man fancying himself to be made of butter, will avoid going into the sun or sitting near a fire; another, who fancied himself to be made of glass, would allow no one to approach or touch him lest he should be broken. A common delusion relates to the presence of poison in food; this leads to abstinence from all kinds of food or from food prepared by a particular person. When these harmless and absurd delusions exist, they require no interference unless they betray the person into acts of violence which are likely to injure himself or others. The mind may be generally unsound, but if the conduct of the person in the ordinary affairs of life is not irrational, there is no reasonable ground for interfering with his liberty of action. Dr. Haslam mentions the case of a well-educated architect, who thought that while he was asleep, ideas leading to splendid discoveries were stolen from his brain by sprites creeping into his ears. To prevent this continued robbery of his intellect, he stuffed his ears with cotton, put on a flannel nightcap, and slept with his head in a tin saucepan! The delusion had here obtained so great a control over the patient's thoughts and actions as to affect his general conduct, and render him a proper subject for an asylum.

Sometimes the monomaniacal idea amounts to a conviction of the loss of personal identity, or of the loss of life. Bandelocque, an eminent French physician, laboured under a delusion of this kind; he believed he had been dead for several years, and referred all who made inquiries after him to his executors. When anyone felt his pulse he affirmed that it was not his own but some other person's. A more remarkable instance is mentioned by Dr. Conolly (Op. cit. p. 288). An old gentleman fancied that he had died some years ago, and he communicated the intelligence of his decease to his family, with an air of perfect resignation; only he professed himself a little shocked to find the windows of the house not closed on the occasion. He would desire that it might be communicated to his absent friends that he went off quietly, —with many other absurdities. These cases show what very curious ideas may be taken up and persisted in by persons who are otherwise possessed of fair powers of reasoning on most subjects.

In judging of the state of a person alleged to be affected with monomania, the existence of occasional illusions of the senses must not be confounded with fixed delusions affecting the mind. Sane persons occasionally suffer from illusions as the result of some bodily disease or physical injury; but they are recognized as such, and do not influence their actions or language. If a person is in a sane state of mind, he does not mistake the illusion for a real object; he has the power, by a single effort of his will, to cause the image to vanish. A lady of good social position, for many months previous to her death, fancied that objects which she looked at took the form of mice. She could for a time dispel the illusion by the aid of her other senses, or by requesting friends to handle different articles or place themselves in chairs on which she saw the mice, so that she might be satisfied that it was an illusion of her senses. This, however, was an indication of incipient disease of the brain, and she ultimately died insane. Illusions in the sane are generally indicative of bodily disease affecting the brain either directly or indirectly.

The phantoms which appear to us in dreams, although believed at the time to be real objects, vanish immediately on waking if the mind and body are in a healthy state. In some cases, however, the false image has been observed to remain for a certain time so as to confuse the judgment of a person. The late Sir B. Brodie records the case of a friend who, on awaking one morning, saw standing at the foot of his bed a figure in a sort of Persian dress. It was as plainly seen and as distinct as the chairs and tables in the room, so that his friend was on the point of going up to it that he might ascertain what or rather who it was. Looking, however, steadfastly at it, he observed that although the figure was as plain as possible, the door behind it was plainly to be seen also, and presently the figure disappeared. Considering the matter afterwards, he recollected that he had had a dream in which the Persian figure played a conspicuous part, and thus the whole was satisfactorily explained; it being evident that the hallucination of the dream, so far as this part of it was concerned, had continued after he was awake, and the perception of the imaginary object had existed simultaneously with that of the real objects. There is no doubt that this is 'the history of many startling and mysterious tales of ghosts and spirits.' ('Psychological Inquiries,' p. 80.) The hallucination of a disturbed dream remains, and the mind if in an unhealthy state is unable to divest itself of the unreality of the images apparently impressed on the senses:—as in the well-known ghost-scene produced by reflection on a sheet of glass, real and phantom (reflected) objects are seen together, and the mind of the waking person is at first unable to disconnect them, or to discover which is the true and which the false image.

The late Sir B. Brodie describes the case of a gentleman, æt. 80, who had a fit which was considered to be apoplectic. He was taken home and bled, and recovered his consciousness; he died, however, in a few days after the attack. During this interval, although having the perfect use of his mental faculties, he was haunted by the appearance of men and women, sometimes in one dress and sometimes in another, coming into and loitering about his room. These figures were so distinct that at first he always took them for realities, and wondered that his family should have allowed such persons to intrude themselves upon him. But as he was quite sane, he soon by a process of reasoning corrected this error, and then talked of them as he would have talked of the illusions of another person. (Op. cit. p. 81.) In this respect he possessed over mind that controlling power which is wanting in insanity. When, however, the brain is in a diseased condition, the senses and judgment cannot correct the sensuous error, and a delusion arises which may be either temporary or permanent; the will is powerless, and the image is believed to have a real and independent existence. The Hon. Mr. Perceval, writing of his condition in the incipient stage of insanity, makes the following statement:—'When I had more liberty, and was aware of my situation, I stood one day in my bedroom before the little square glass, reflecting upon self-destruction, upon which I had always looked as a cowardly, mean, ungenerous action. Perhaps it was after having heard a patient make some painful remarks on it before others,—perhaps it was after hearing a servant describe how one of the patients had put his head under a cart-wheel: but, at the time, I was considering also how a man could summon boldness to endure the bodily pain, as well as obliterate moral feeling,—when my right arm was suddenly raised, and my hand drawn rapidly across my throat, as if by galvanism.' (Op. cit. p. 171.) This gentleman after his recovery had a relapse, and committed suicide in 1840 by throwing himself from a window.

The delusion of a monomaniac will be generally uppermost in his mind: his will is powerless to dismiss it, just as in mania the will is powerless to stop the constant and rapid succession of different and perhaps heterogeneous ideas which present themselves to the mind in this form of insanity. Esquirol mentions the case of a patient, who employed himself in running up and down the ward of the asylum, and in striking at the shadow of his person with a stick; the faster he ran, the more violently he struck. It was found that this man did not recognize his own shadow, but he had the fixed delusion that it was a large number of rats which were incessantly pursuing him.

In the first stage of monomania the judgment may be strong and the mind apparently sound upon every point except the particular subject of delusion, and even, in some instances, there may be such a control over this delusion, that it would be difficult to discover whether or not there was any just ground for imputing mental unsoundness; but in a more advanced form of the disease, the delusion, whatever it may be, whether relating to wealth, ambition, religion or politics, so overpowers the patient that he loses self-control. His character is changed, and his habits are such as to render him unfit for social intercourse; he becomes incoherent; his ideas are perverted on all subjects, and he gradually lapses into mania or dementia. The last condition happens when the monomania is of long standing. Monomania may be remittent or intermittent, and it is sometimes accompanied with lucid intervals. Its progress is rapid, and its termination often unexpected: in some instances the disease ceases suddenly without any previous warning, owing to the effects of a strong moral shock or impression.

Monomania, in its early stage, is liable to be confounded with *eccentricity*: but there is this difference between them. In monomania there is obviously a change of character,—the person is different from what he was: in eccentricity such a difference is not remarked; he is, and always has been, singular in his ideas and actions—there is no observable change of character. An eccentric man may be convinced that what he is doing is absurd and contrary to the general rules of society, but he professes to set these rules at defiance: a true monomaniac cannot be convinced of his error, and he thinks that his acts are consistent with reason and the general conduct of mankind. In eccentricity there is the will to do or not to do: in real monomania the controlling power of the will appears to be lost. Eccentric habits suddenly acquired are, however, presumptive of insanity. It will be seen hereafter that the distinction of these states is of considerable importance in relation to the testamentary capacity of persons.

Monomania frequently assumes one of two forms: either the thoughts are lively and gay, or they are oppressed with gloomy melancholy. In the first state, the persons will fancy themselves to be kings and queens, and overflowing with wealth, which they are prepared to distribute with regal profusion; in the second state, we find silence, seclusion, and the most heart-rending sorrow. The latter condition, by no means uncommon as a form of monomania, is called *Melancholia* (mania with depression,) or *lypemania* (λύπη, *sorrow*). Those who are affected with it suppose they have committed some unpardonable sin, and pass their hours in silence and in the most gloomy forebodings of temporal and eternal punishment. They do not sleep, and will sometimes neither eat, speak, nor move; force must be used to make them take food and exercise. In some instances no persuasion can conquer their silence; one patient thus affected was not heard to utter a word during four years. If spoken to they shed tears and violently repulse the person who addresses them. Melancholia frequently leads to an act of suicide or murder, and persons affected with it require very close watching. In the lighter forms of the disease there is no sign of mental aberration and the patient will go through his usual routine of duty, but always with the same desponding air—so that his occupation seems scarcely to distract his thoughts from the delusion for a single instant. In other cases the delusion is so well concealed that no suspicion exists, until an act of suicide leads to inquiry, and some evidence of strangeness of conduct is then for the first time forthcoming. There is either an entire absence of motive for the act, or the motive is based on a delusion.

Suicidal monomania, or *suicidal mania*, is the name given to that form of insanity which is marked by the predominant idea of self-destruction. Its approach is insidious: it is foreshadowed by impaired appetite and sleeplessness arising from some cause of mental anxiety—too trivial to create alarm. It may proceed either from sudden impulse or be the result of long deliberation; it may be committed with or without apparent motive; it may proceed either from a delusive or a real apprehension of poverty, disgrace, or ruin. Suicide from sudden impulse is not uncommon: persons have been known to destroy themselves who had not previously manifested any symptoms of *intellectual* disorder. Sir Charles Bell relates that one of the surgeons of the Middlesex Hospital was in the habit of going every morning to be shaved by a barber in the neighbourhood, who was known as a steady industrious man. One morning the surgeon was conversing with the barber about an attempt at suicide which had recently occurred, and the surgeon observed that the man had not cut his throat in the right place. The barber then inquired, casually, where the cut should have been made; the surgeon pointed on his neck to the situation of the carotid artery. The barber in a few minutes retired to the back of his shop, and there cut his throat with the razor with which he had been shaving the surgeon; he had wounded the carotid artery in the place indicated by the surgeon, and died before any assistance could be rendered to him. Although this act was quite sudden and unexpected, it may have been only the final result of a delusion which had long existed, concealed from others, in the mind of this man—just as the sight of a weapon has often led to its use for the purpose of suicide.

Dr. Forbes Winslow remarks 'that a person is often impelled to self-destruction by the overpowering and crushing influence of a *latent* delusion that has for weeks, and perhaps months, been pressing like an incubus on his imagination. Patients sometimes confess that they have been under the influence of monomaniacal ideas and terrible hallucinations for a long period without their existence being suspected even by their most intimate associates. "For six months," writes one patient, "I have never had the idea of suicide, night or day, out of my mind. Wherever I go an unseen demon pursues me, impelling me to self-destruction! My wife, friends, and children observe my listlessness and perceive my despondency, but they know nothing of the worm that is gnawing within." Is this not a type of cases more generally prevalent than we imagine?' ('Obscure Diseases of the Brain,' p. 265.) The want of power to shake off this delusion shows clearly that the mind is not in a healthy state —that the person is not sane.

Men who are thus mentally affected generally retain a certain control over their actions; thus they will voluntarily give up pistols, razors, or other weapons by which suicide might be perpetrated. A friend suffering from an attack of suicidal mania, while residing with me in Paris in 1830, delivered to me one night his razors, with a request that I would lock them up and keep them out of his sight, as otherwise he feared that he might destroy himself at any moment. Although he recovered from this attack, he had a relapse, and subsequently destroyed himself by taking prussic acid. Persons labouring under this form of monomania may go to bed perfectly collected, and suddenly awake in the night and destroy themselves by hanging, drowning, or precipitating themselves from a window. These cases probably depend on the persistence of some horrible hallucination which may have occurred in dreaming, and in the reality of which they cannot at the time disbelieve. Some years ago I saw a case of this kind in a man who was a patient at Guy's Hospital. The man attempted to strangle himself in the dusk of the evening with the cord of his bed; he was fortunately saved, and he recovered after having been nearly strangled. On asking him what led him to the attempt he told me that he suddenly saw a large black figure round his bed (the devil), which by signs and words compelled him to try and hang himself. It appeared that this man had previously shown symptoms of suicidal monomania.

When the impulse to suicide is checked by any great moral shock it may suddenly disappear. My friend, to whose case I have above referred, recovered under the shock from the sudden outbreak of the French Revolution of 1830. The danger to which he was exposed, while residing with me in Paris in the early days of the revolution, for a time at least dispelled the idea of self-destruction. Pinel mentions the case of a man who while hurrying to one of the bridges of Paris to throw himself into the river, was suddenly attacked by robbers; he made a desperate resistance, and escaped from them. He could not then account for his being where he was, and quietly walked home, having abandoned the intention of destroying himself. There is but little doubt that many acts of suicide would be prevented if circumstances only gave a slight opportunity for reflection; the mind would then be diverted from the dominating idea of self-destruction.

Suicidal mania is susceptible of being spread by imitation, especially when the mode of self-destruction adopted is accompanied by circumstances of a horrible kind, or by such as excite great notoriety. The sight of a particular spot where an act of suicide has been already committed will often induce a person, who may hitherto have been unsuspected of any such disposition, at once to destroy himself. Thus a second and a third suicide took place from the Monument near London Bridge, soon after the first had occurred. Acts of incendiarism have been also observed to lead to arson in the same or in a neighbouring district; but there is here a criminal as well as a monomaniacal imitation, and experience has clearly shown that there is no check so effectual for this as the rigorous application of the law.

Does the act of suicide necessarily indicate the existence of insanity?—Suicide is often set down as furnishing positive evidence of insanity: a doctrine which commonly finds expression in the verdicts of coroners' juries—not so much from the fact of insanity being thereby established, as that any verdict but this would weigh heavily, not on the deceased but on his surviving relations and friends.

In the opinion of Dr. Davey, the suicidal propensity is in all cases and under all circumstances a positive sign or symptom of disordered mind (insanity). ('Journal of Mental Science,' April 1861, p. 110.) This, however, is not in accordance with the views of many psychologists. In one case a person will fancy that he is constantly watched,—that he is oppressed and persecuted by all around him, and that his prospects in life are ruined when, on the contrary, his affairs are known to be flourishing: he destroys himself under this delusion, in order to avoid imaginary evils. In cases of this description, whether arising from a momentary insane impulse or from delusive reasoning, there cannot be a doubt that the act is one of insanity. It is very different, however, when a real motive is obviously present,—as when a person destroys himself to avoid actual disgrace or impending ruin. The motive is here based on a reality—on a real estimate of the man's position; the results are clearly foreseen, and the suicide calculates that the loss of life would be to him a smaller evil than the loss of honour and fortune. It may be urged that a motive of this kind is itself delusive, and will appear insufficient to the minds of most men; but what known motive is there sufficient to account for parricide, infanticide, or any other crime of the like horrible nature? It appears to me, we must allow either that all crime is the offspring of insanity, or that suicide, like infanticide, may be the deliberate act of a *sane* person. To affirm that suicide is always *per se* evidence of insanity is to affirm, substantially, that there is no criminality in self-murder: for it is impossible to regard that act as a crime which is committed under a really insane delusion. (See 'Ann. d'Hyg.' 1831, vol. 1, p. 225: for some additional remarks on this subject, see Lectures by Dr. Jamieson, 'Med. Gaz.' vol. 46, p. 523, and 'Journal Psychol. Med.' 1850, p. 19.)

The law of England very properly treats suicide as a felony; those who have attempted and failed in its perpetration are held to be sane and responsible agents, unless there should be clear evidence of their (intellectual) insanity from other circumstances: and it is certain, that the evidence required to establish this must be much stronger than that sometimes admitted in cases of homicide.

Some singular medico-legal cases have occurred, involving the question how far the act of attempting suicide is indicative of insanity. In the case of the *Queen* v. *Rumball* (Cent. Crim. Court, May 1843), a woman was charged with attempting to drown her child. It appeared in evidence that she had fastened her child to her dress, and thrown herself into a canal with the intention of destroying herself. She was rescued, and was subsequently tried and convicted of the felony of attempting to murder her child by drowning. Had she not been rescued, and had she succeeded in her purpose of self-destruction, it is probable that the verdict of a jury would have been, as it so frequently is on these occasions,—'Temporary insanity.' In *Reg.* v. *Furley* (Cent. Crim. Court, April 1844), the prisoner was convicted of murder under similar circumstances, but the sentence was subsequently commuted. In *Reg.* v. *Gathercole* (1839), a man was charged with manslaughter, under the following singular circumstances. The prisoner threw himself into a canal for the purpose of drowning himself: the deceased, who was passing, jumped in and rescued him, but by some accident he was himself drowned in the humane attempt. The defence was, that the prisoner was at the time insane, and therefore not responsible for the death of the person who attempted to save him; but this was negatived, and the prisoner was convicted. So if a man intending to shoot himself fails, and by accident shoots a bystander, he will be held responsible, unless there be a clear proof of intellectual insanity: the act—the attempt itself, taken alone, will not be admitted as evidence.

If two persons agree to commit suicide, and one only dies, the survivor is guilty of murder. In *Reg.* v. *Fisher* (Taunton Spring Assizes, 1865), the prisoner, was indicted for the murder of his wife by poison. It appeared from the evidence that they had been married fourteen years, and had lived happily together. The man was well-conducted and industrious; but he fell into a desponding state of mind, and thought that by the introduction of machinery into his trade of a shoemaker, he and his wife would be reduced to poverty. He communicated this feeling to his wife; they pondered over it together, and they both agreed to destroy themselves. The man procured a quantity of laudanum, and shared it with his wife; they took about an ounce each. The wife died, but owing to early vomiting the prisoner recovered. It was proved that before marriage the prisoner had been confined in a lunatic asylum: still, he had perfectly recovered, and just before this occurrence it was observed that both husband and wife were low and dispirited. There was then no indication of intellectual insanity about him; and the only delusion appeared to be that machinery would ruin his trade. In answer to the charge he said, 'According to my notion I am not guilty of murder.' The case is like that of many others,—of two poor, weak-minded, infatuated people agreeing to commit suicide. Under the direction of the judge, the jury returned a verdict of guilty.

Suicide in relation to life-insurance.—It is well known that according to the rules of some English Offices a policy of life-insurance is forfeited by the act of suicide; but supposing it to have been really an act of insanity, it has been doubted whether the policy would be legally forfeited. In an equitable view the policy should not be forfeited under these circumstances, any more than if the party had died accidentally by his own hands. The condition equitably implies that the assured party puts himself to death *deliberately* and not unconsciously through a delusion as the result of a fit of delirium or an attack of insanity. This question was raised in the case of *Borradaile* v. *Hunter* (Dec. 1841). An action was brought to recover the amount of a policy of insurance effected on the life of a clergyman who threw himself into the Thames from Vauxhall Bridge, and was drowned. The whole case turned upon the legal meaning of the words '*die by his own hands*,' which formed the exception in the proviso to the payment of the policy. At the trial of the case, Erskine, J., directed the jury, that if the deceased threw himself into the river knowing that he should destroy himself and intending to do so, the policy would be void; they had further to consider whether the deceased was at the time capable of distinguishing between right and wrong, or, in other words, whether he had a sufficient knowledge of the consequences of the act to make him a felo-de-se. The jury found that the deceased threw himself into the water intending to destroy himself, and that previously to this act there was no evidence of insanity. They were then directed to take the *act itself* with the previous conduct of the deceased into consideration, and say whether they thought he was at the time capable of knowing right from wrong. They then found that he threw himself from the bridge with the intention of destroying himself, but that he was not then capable of judging between right and wrong. The jury were here evidently perplexed with the strict meaning of the words right and wrong: the first part of the verdict made the case one of felo-de-se, the last part made it one of insanity. The verdict was entered for the defendants—*i. e.*, that the deceased was a felo-de-se, and that the policy was therefore void.

This case was subsequently argued before the four judges in the Common Pleas (May 1843). It was then contended for the plaintiff, that according to the terms of the policy there must have been an *intention* by the party assured to 'die by his own hand,' and that an insane person could have no controllable intention. The judges differed:—three thought there was no ground for saying that the deceased was affected by an uncontrollable impulse; on the contrary, the jury had found that he threw himself into the river knowing that he should destroy himself, and intending to do so. In their opinion the act was one of felo-de-se, and the policy was void. Tindal, C. J., considered, that the verdict should be for the plaintiff, thereby leading to the inference that the act of suicide was in this case the result of insanity, and not of a felonious killing, to which alone he considered the exception in the proviso should apply. It is probable if the term '*suicide*' had been inserted in the policy, instead of the words '*die by his own hands*,' that the decision would have been in favour of the plaintiffs; for to vitiate a policy from an accidental result depending on an attack of insanity and *flowing directly from that attack*, is virtually vitiating it for the insanity itself! In this respect, it appears that the learned Chief Justice took a sound and equitable view of this question, so important to the interests of those who have insured their lives. It is impossible for a man to enter into a contract *against an attack of insanity*, any more than against an attack of apoplexy! The jury found that the deceased was irresponsible for the act, and it is clear that the insurers and insured intended no more by using the terms 'die by his own hands,' than the act of suicide. By this decision, therefore, the insurers received the benefit of a wider interpretation of the terms than that which either party could have foreseen or contemplated.

The question was again raised in the case of *Schwabe* v. *Clift*, Liverpool Summer Assizes, 1845. ('Med. Gaz.' vol. 36, p. 826.) The deceased, whose life was insured, destroyed himself by taking sulphuric acid; there was clear evidence of his being at the time in a state of insanity. The jury here, under the direction of Cresswell, J., returned a verdict for the plaintiffs, thereby deciding that the policy was not vitiated by the mere act of *suicide*. The learned judge held that to bring the case within the terms of the exception, the party taking his own life must have been at the time of the act, *an accountable moral agent and able to distinguish right from wrong.* In this instance the term used in the policy was 'suicide,' which according to the learned judge meant 'a *felonious* killing.' Supposing that the insured party was killed by voluntarily precipitating himself from a window while in a fit of delirium from fever, this would be an act of suicide or dying by his own hand; but it surely cannot be equitably contended that his heirs should lose the benefit of the insurance in consequence of an event depending on an accidental attack of a disease which no one could have foreseen, and against which no one could guard? If this principle be not admitted, the decision which must necessarily follow would appear to be against all equity; if it be admitted, then it must apply equally to every case of mental disorder, the proof of the existence of this resting with those who would benefit by the policy.

On an appeal, the judgment in this case was however reversed, the judges again differing. It was argued for the insurers, that if a man retained just enough of intelligence to produce death by competent means, but was deprived of all *moral sense*, the policy was void. Against this view it was urged by one of the judges, that whether the intellect was destroyed altogether, or only partially, it could make no difference. If death was the result of disease, whether by affecting the senses or by affecting the reason (thus leading to suicide), the insurance office was liable under the policy. If the act was not the act of a sane and reasonable creature, it was not an act of suicide within the meaning of the proviso. Those judges who adopted the opposite view held that the meaning of the words, as introduced into the exception, was — if the party should kill himself *intentionally*: the words were considered to include all cases of voluntary self-destruction. If a party voluntarily killed himself, it was of no consequence whether he was sane or not. The majority of the Court held this view, and a new trial was granted. Had all the judges been present to give their opinions, the decision might have been different; for five had expressed themselves at various times in favour of the view that the term suicide in policies applies, as it ought to do, only to cases in which there is no evidence of insanity; while four had declared their opinion to be, that it includes all cases of 'intentional' self-killing, whether the person be sane or insane. It is difficult to understand how a man in a fit of delirium or insanity can be said to kill himself voluntarily or intentionally. Will and intention imply the judgment of a sane man in regard to civil and criminal acts, but a delirious or really insane person acts under a delusion; and as the law would hold him irresponsible in regard to others, his representatives should not suffer for an act which he was himself incapable of controlling. (See 'Law Times,' July 18, 1846, p. 342.)

The decision in this case is of great importance to persons whose lives are insured, for it may be made to govern others; and on this principle, a man attacked with delirium, and who during the fit precipitated himself from a window and was killed, would be declared a suicide within the meaning of the proviso, and a policy of insurance on his life would be *ipso facto* void. It will be perceived that the law, as interpreted by a majority of the judges, is that whenever a person destroys himself *intentionally*, whatever may be the state of his mind, the policy becomes void. It also appears that, according to this legal view of the question, a person may have and exercise his intention although undoubtedly *insane*. Whether he has been found so under a Commission, or a verdict to this effect has been returned by a Coroner's Jury, is therefore unimportant. It must be proved by those who would benefit by the policy, that the party died from his own act without *intending* to destroy himself. If a man take poison, or shoot himself, or commit any other act leading to his own death, it must be shown that it was the result of *accident*, and not of design on his own part. Some Insurance offices now insert in the contract a proviso by which, whether the person be found *felo-de-se* or not, the policy shall be forfeited: but they reserve to themselves the power of returning a part or the whole value of the policy, calculated up to the day of death. In the meantime they have the power of taking the full benefit arising from an act of suicide committed during a fit of delirium or insanity, in which, as medical men know, there can exist no controllable intention, no freedom of judgment and no real exercise of will. (See case 'Prov. Med. Jour.' Aug. 9, 1848, p. 428.)

There is a form of suicide not unlikely to present itself for consideration —namely, where a man, in the habit of using a powerful drug for medicinal purposes, takes a large dose while in a state of intoxication and dies. In May 1857 a *Mr. George Fife* died from an overdose of morphia, and it was proved to the satisfaction of the jury that this must have been taken while he was intoxicated. In such a case a man may have no sane intention of destroying himself, yet he dies by his own hands. As drunkenness does not excuse or justify any act of homicide, so it would not probably be allowed to affect the question of suicide; and death under such circumstances would probably be held to be a felonious killing.

From these cases one fact is clear,—the act of suicide is not treated by the law as a necessary *proof of insanity*; and therefore the ingenious arguments which have been held on this subject have but little interest for a medical jurist in a practical view. It has been elsewhere stated that acts of suicide have been mistaken for homicide, merely because the deceased had expressed no *intention* of destroying himself, and had manifested no disposition to the act by his previous conduct. This, however, is a fallacious view of the subject, since suicide from sudden impulse is by no means unfrequent; and even when the act bears about it marks of deliberation, it is not to be expected that a person should previously announce his intention, for this would be a sure way of defeating his object.

If, as it is alleged, the act of suicide was in all cases the offspring of insanity, suicide should be frequent among the insane. Experience, however, is not in favour of this assumption. The Report of the Commissioners of Lunacy for 1850 shows that there were then confined as lunatics 15,079 persons, while the suicides for the year among this large number amounted to only eight, of which six were perpetrated by strangulation. As mechanical restraint is either abolished or considerably diminished in most asylums, lunatics have now much more liberty than formerly, and yet suicides among them are comparatively rare. This favourable result must be in part ascribed to active superintendence and watching.

The tendency to suicide appears to be in some cases hereditary. Dr. Burrows relates an instance in which this propensity declared itself through three generations: in the first, the grandfather hanged himself: he left four sons—one hanged himself, another cut his throat, and a third drowned himself in an extraordinary manner, after having been some months insane: the fourth died a natural death, which, from his eccentricity and irregularity of mind, was scarcely to be expected. Two of these sons had large families: one child of the third son died insane, two others drowned themselves, another became insane and made the most determined attempts on his life. Several of the progeny of this family, being the fourth generation, when they had arrived at puberty, showed a tendency to the same fatal propensity.

Other forms of monomania are mentioned by medico-legal writers, as *pyromania* and *kleptomania*: the first signifying a mental or moral perversion, manifested by a propensity to incendiarism; the second, the same manifested by a propensity to theft. The Germans and the French admit these forms of monomania, and consider that when they are proved to exist, they ought to be allowed as defences to charges of arson and theft; this is a point which will require consideration hereafter.

Some have held that monomania is capable of being transmitted by imitation in all its varieties. It is certain that weak and enthusiastic minds are often prone to take up delusions connected with political or other doctrines, which perhaps in the first instance emanated from the brain of a monomaniacal fanatic. The same delusion may be taken up by many maniacs successively: thus one maniac pretender to the throne of a country will be followed by many other pretenders, equally insane; one person who announces himself as a prophet or a spiritualist will have his wildest fancies credited by an ignorant multitude. We can only explain these cases by supposing that there is an inherent weakness in some minds, which renders them easily susceptible of delusion. Such cases are generally observed among the most ignorant and credulous, but sometimes they are found among the educated and well-informed classes of society.

CHAPTER 81.

DEMENTIA—IDIOCY—IMBECILITY—HEREDITARY TRANSMISSION OF INSANITY—FEIGNED INSANITY—STATISTICS.

DEMENTIA.

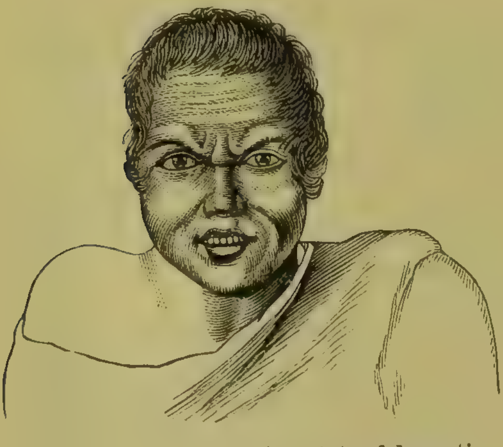
THIS is a state which, although sometimes confounded with mania, is very different in its characters. Dementia, when confirmed, consists in a total absence of all reasoning power, and an incapacity to perceive the true relations of things; the language is incoherent, and the actions are inconsistent; the patient speaks without being conscious of the meaning of what he is saying; memory is lost, and sometimes the same word or phrase is repeated for many hours together; words are no longer connected in meaning, as they are in mania and monomania. This state is often called *fatuity*; it is a not unfrequent consequence of mania or monomania.

Dementia varies in degree. The disordered mind of aged persons is one form of dementia; here we find memory and some mental power, although the memory is restricted to objects long since past, and the exertions of the mind are only momentary. Some persons in dementia are quiet, others are in constant motion as if in search of something. There is generally a strong disposition manifested to collect all kinds of useless articles, which are hoarded up as if they were of great value. In some instances this disease comes on gradually—the faculties both normal and intellectual, decay one by one; while in other instances, although much more rarely, dementia may occur suddenly from a violent shock or impression on the mind. This was the case with the young lady, referred to by Mr. Travers, who suddenly fell into dementia from finding in her bed a skeleton, which had been placed there by some person to frighten her; in the morning she was found playing with the fingers of the skeleton, and all reasoning power was extinct. The following instance of dementia occurring suddenly from violent emotions is related by Marc: ‘During the Reign of Terror in France, an artilleryman proposed to the Council of Public Safety, a new species of cannon which was to have the most deadly effects in war. A day was appointed for the trial of this invention at Meudon, and Robespierre wrote a letter to the inventor, thanking him for his discovery in such flattering language that the poor man became motionless on reading it. His mind was gone, and he was conveyed to a lunatic asylum in a state of confirmed dementia.' 'De la Folie,' vol. 1, p. 269.) There is something fearful in the thought that the powers of the mind, which it may have taken many years to build up, may be thus destroyed in a moment by strong emotion.

Dementia may be acute or chronic, remittent or intermittent. The countenance of the patient is generally pale, vacant, and without expression, the look vague and uncertain, and tears are abundantly shed from the slightest causes.

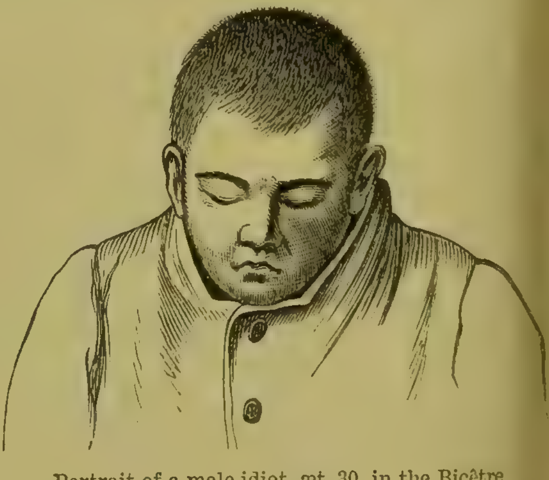
The following may be taken as the most striking differences between mania and dementia. In mania there is an incoherence of ideas, but depending on too great rapidity of thought and excitement of the intellectual powers; in dementia there is a want of ideas, and the incoherence depends on the loss of the power of connecting them, owing to defect of memory; volition is lost, and the brain seems in a state of collapse. (Esquirol, 'Maladies Mentales,' vol. 2, pp. 224 and 232.) In fact, in dementia there is a more or less complete abolition of the moral, intellectual, and voluntary powers; in mania, and also in monomania, they are in a state of perversion. Dementia is often a consequence of these states, and sometimes alternates with them. The annexed illustration (fig. 1) represents a woman in a state of dementia; she did not speak, and commonly maintained a sitting posture; she was of gluttonous habits, and ate ravenously anything upon which she could lay her hands; she was unable to dress herself, and appeared not to remember even the cell in which she was confined, or to know anything that was passing around her.

Fig. 1.



Portrait of a woman in a state of dementia (Esquirol).

Fig. 2.



Portrait of a male idiot, æt. 30, in the Bicêtre (Esquirol).

Idiocy. Imbecility.

Idiocy is the *dementia naturalis* of lawyers. The term idiot is applied to one who from original defect has never had mental power. Idiocy differs from the other states of insanity in the fact that it is marked by congenital deficiency of the mental faculties. There is not here a perversion or a loss of what has once been acquired, but a state in which, from defective structure of the brain, the individual has never been able to acquire any degree of intellectual power to fit him for his social position. It commences with life and continues through it, although idiots are said rarely to live beyond the age of thirty. (Esquirol, 'Maladies Mentales,' vol. 2, p. 284.) The deficiency of intellect is marked by a peculiar physiognomy, an absence of all expression, and a vague and unmeaning look (see fig. 2); there is no power of speech, or only the utterance of a cry or sound; there is no will, but the actions of these beings appear to depend upon impulse, a power of imitation, or mere animal instinct; they recognize no one, they remember no one, and the mind seems to be a blank. Such is the picture of what may be termed a perfect idiot. In Switzerland this state of idiocy is often accompanied with great bodily deformity, and enlargement of the thyroid gland, both in males and females; it is there termed cretinism. Cretins resemble monsters more than human beings. A confirmed idiot may in almost all cases be recognized by the expression of countenance and the form of the skull.

Idiocy is not always so complete as this description would represent. There is a state scarcely separable from idiocy in which the mind is capable of receiving some ideas, and of profiting to a certain extent by instruction. Owing, however, either to original defect, or to a defect proceeding from arrested development of the brain as a result of disease or other causes operating after birth, the minds of such persons are not capable of being brought to a healthy standard of intellect, like that of an ordinary person of similar age and social position. This state is called *imbecility*; it is nothing more than idiocy in a minor degree. In common language, persons labouring under it are often called idiots, but for the sake of precision in medical language they are more correctly described as imbeciles. (Esquirol, Op. cit. vol. 2, p. 289.) In imbecility the physical organization differs but little from the ordinary standard; the moral and intellectual faculties are susceptible of cultivation, but to a less degree than in a perfect man, and even this capacity does not exist beyond a certain point. Imbeciles never attain a normal standard of intellect, and when placed in the same circumstances as other men they never make a similar use of their intellectual powers. They can form no abstract ideas, and sometimes their capacity to receive instruction is limited only to a certain subject—as for instance arithmetic. Their memory and judgment are limited, although sometimes the former is remarkably strong. They express themselves in a hesitating manner, and differently from other men; they require time to perceive the relations of objects which are immediately perceived by sane persons. The degree to which imbecility exists is well indicated by the power of speech. In idiots there is no speech, or only an utterance of single words; in the better class of imbeciles the speech is often easy and unaffected, while there is every grade between these two extremes. Some have arranged imbeciles in classes, according to their capacity to receive instruction—others according to their power of speech; but such divisions are practically without value: each case must be judged by itself.

The precise boundary between idiocy and imbecility cannot be defined. The major degrees of imbecility approach so closely to those of idiocy, that there is no distinction between them, and in a practical view no distinction is required. Idiocy has been here described as that condition in which the congenital defect is not susceptible of being removed by any kind of instruction; but many medico-legal writers apply the term idiot to one who does manifest capacity to receive instruction, although in a low degree. The difference is immaterial so long as the meaning of the word is understood.

How are the minor degrees of imbecility to be distinguished from sanity? This is a question by no means easy to answer, for the reason that sane persons differ remarkably in their mental power to receive instruction, to retain what they have been taught, and to allow them to make a practical use of it in the world for their own benefit. How many persons pass through life and advance in the world who are yet undoubtedly weak-minded, and who have the reputation among all who know them of being so! The truth is, the lowest degrees of intelligence legally constituting sound mind, are not separable from the minor forms of imbecility, so far as the moral and intellectual faculties are concerned. By running this distinction too closely, one half of the world might easily reason itself into the right of confining the other half as insane.

Idiocy and imbecility must not be confounded with mania and monomania. In idiots and imbeciles ideas are wanting, and the power of thought is absent or defective; in maniacs and monomaniacs the ideas flow freely, but they are perverted, and the power of thought is irregular and uncontrolled. In idiocy and imbecility we do not meet with the hallucinations and illusions which constitute the main features of mania and monomania. Idiocy is much more likely to be confounded with dementia, and indeed, when dementia is confirmed and complete (*fatuity*,) there is no appreciable difference, for in neither state is there any evidence of the exercise of mental power. In idiocy no ideas have ever been formed; in imbecility they have been partially formed, but arrested; in dementia they have been more or less completely formed, but have subsequently become entirely obliterated. It is important to remember that in idiocy and imbecility there is no gradual loss or impairment of faculties, as is generally observed in dementia; the person is what he always has been—mentally weak and unsusceptible of any great degree of improvement by instruction.

From these remarks it will be perceived that imbecility is a state existing from birth or from childhood—for it is possible that it may supervene from disease after birth, in a child in whom there was no reason to suspect its existence—but it is more common to find the deficiency congenital. Still, the term is often applied to that weakness of the mental powers which takes place in the aged at the close of life, even when the mind has been well developed in maturity. Thus we speak of the imbecility of age: this is truly nothing more than a state of *senile dementia*, and to apply to it the term 'imbecility' tends to create confusion.

Such then are the four forms under which insanity or mental aberration may present itself to our notice, and although there are occasionally mixed states, as of mania and dementia (*incoherency*), yet it is an important feature in the distinction of mental disorders, to observe that in real insanity the characters presented to us in any given case do not vary materially from those which have been described as peculiar to each of these states. This medical classification, it must be remembered, is made for the sake of convenience, because by it a practitioner may be led to form a safe diagnosis of the real state of mind of a person. It is not recognized in any of the law-proceedings connected with the insane: for in these the term *unsoundness of mind*—comprehending lunacy, idiocy, imbecility, and all forms of mental weakness—is almost exclusively employed. In adopting this arrangement, a medical jurist must take care not to fall into an error which has been sometimes committed—*i. e.* of pronouncing a person to be of sound mind, because his case could not be easily placed in any one of these four great divisions of insanity. This would be as serious an error as that formerly committed by some law-authorities—namely, of giving restricted and incorrect definitions of lunacy, idiocy, and imbecility, and then contending that whoever was not a lunatic, idiot, or imbecile, according to these arbitrary legal definitions, must be a person of sound mind.

Hereditary transmission.—The hereditary transmission of insanity has sometimes presented itself as a medico-legal question in relation to the criminal responsibility of the insane. According to Chitty, it is an established rule of law, 'that proof that other members of the same family have decidedly been insane is not admissible either in civil or criminal cases.' ('Med. Jur.' vol. 1, p. 352.) But recent decisions have shown that this statement is not correct. In *Reg.* v. *Ross Touchet* (1844), in which the accused was tried for shooting a man, and acquitted on the ground of insanity, (Maule, J.) held that evidence that the grandfather had been insane might be adduced, after it had been proved by medical testimony that such a disease is often hereditary in a family. It was also admitted in *Oxford's* case,—the prisoner having been tried for shooting at the Queen ('Law Times,' Oct. 26, 1844), and since that date it has been admitted in a number of cases in which insanity was urged as a defence on a charge of murder. This kind of evidence has, however, been frequently rejected, and it is not admitted in the law of Scotland. (*Gibson's* case, Edinburgh, December 1844.)

There can be no doubt, from the concurrent testimony of all writers on Insanity, that a predisposition to this disease is frequently transmitted from parent to child through many generations. The malady may not always show itself in such cases, because the offspring may pass through life without being exposed to any exciting cause; but in general it readily supervenes from very slight causes. M. Esquirol has remarked that this hereditary taint is the most common of all the causes to which insanity can be referred, especially as it exists among the higher classes of society. Among the poor, about one-sixth of all the cases may be traced to hereditary transmission; and other authorities have asserted that in more than one-half of all cases of insanity, no other cause can be found for the malady. As we might suppose, children that are born before insanity manifests itself in the parents, are less subject to the disorder than those which are born afterwards. When one parent only is insane, there is less tendency for the predisposition to be transmitted than when both are affected; but according to Esquirol, this predisposition is much more readily transmitted through the female than through the male parent. Its transmission is also more strikingly remarked when it has been observed to exist in several generations of lineal ancestors; and, like other hereditary maladies, it appears to be subject to *atavism*—*i.e.* it may disappear in one generation and reappear in the next. Further, the children of drunken parents, of those who have been married late in life, or who are of blood-relationship, are said to be more subject to insanity than children born under other circumstances. When insanity is transmitted by hereditary descent, it appears often about the same age, under the same form, and is induced by the same exciting cause in the offspring as in the parent. This it is proper for a medical jurist to bear in mind in reference to the plea of insanity in criminal cases. (See 'Journal of Psychol. Med.' 1848, p. 264.)

The following instance of the effects of hereditary transmission in the family of a tailor occurred to Dr. Millar. The wife of the man had always been an epileptic and had had eighteen children, of whom, at the time to which he refers, six were living,—all more or less affected with epilepsy and congenital deficiency; six had died at various ages of convulsions, and six were prematurely born dead during her own attacks. ('Hints on Insanity,' p. 57.) As a rule, he considers that the father transmits to the son, and the mother to the daughter.

The extent to which the disposition to insanity prevails through families is much greater than is commonly supposed, but there is great difficulty in getting at the truth, unless the information can be obtained from some friend who is well acquainted with the family. There is no point upon which persons in every station of life are more desirous of concealment; and relatives are always ready to deny the existence of a family-taint. They will admit, perhaps, that some member of the family has been a little eccentric—nothing more than that; one has only had a brain-fever—another delirium after her confinement, which they say goes for nothing; or perhaps it will be admitted that some child has had congenital deficiency. (Millar's 'Hints on Insanity,'

p. 10.) Dr. Millar states, as the result of his experience, he has good reason for believing that many of the reputed attacks of brain-fever have been nothing more than cases of acute mania. In spite of the existence of a strong hereditary taint, however, insanity rarely manifests itself except when the exciting cause leads to the loss of natural sleep.

Among the ordinary *causes* of insanity may be enumerated severe domestic affliction—loss of near relatives or friends—great pecuniary losses—disappointments—long watching—anxieties either as to the health of friends or success in business—severe and long-continued mental exertion—excessive study—ambition—the puerperal state—amenorrhœa—masturbation—over-excitement on the subject of religion or politics, and in general all those disorders which cause depression of health and spirits, and which are accompanied by a loss of sleep. About one-third of the existence of man is passed in sleep, and this quiescence or repose is as necessary to mental as it is to bodily health. One of the earliest symptoms of insanity is extreme wakefulness. (Millar, Op. cit. p. 9.)

Blows on the head, accidental falls, and strokes of lightning have been said to cause insanity. It is very probable in reference to these mechanical injuries, that but for an hereditary taint in the person they would not be followed by an attack of insanity.

Feigned insanity.—Insanity is frequently feigned by persons accused of criminal offences in order to procure an acquittal or discharge. In the first place, when feigning is suspected, it will be proper to inquire whether the person has any *motive* for pretending to be insane. It is necessary to remember that insanity is never assumed until *after* the commission of a crime and the actual detection of the criminal. No one feigns insanity merely to avoid suspicion. In general, as in most cases of imposture, the part is overacted—the person does either too much or too little, and he betrays himself by inconsistencies of conduct and language which are never met with in cases of real insanity. There is commonly some probable cause to which insanity may be traced, but when the malady is feigned there is no apparent cause: in this case the appearance of the assumed insanity is always sudden—in the real malady, the progress of an attack is generally gradual; and when the attack is really sudden, then it will be found to be due to some great moral shock or other very obvious cause. We should observe whether for some time previously there has been any marked change of character in the person, or whether his conduct, when he had no interest to feign, presented any of the usual indications of insanity. Some difficulty may arise when fits of eccentricity or strangeness of character are deposed to by witnesses; but these statements may be inconsistent with each other, and the previous acts of the person may bear no resemblance whatever to those performed by him in the recently assumed condition. A difficulty of this kind rarely presents itself, since in an impostor no act indicative of insanity can be adduced for any antecedent period of his life: it is only *after* the perpetration of a crime and its detection, that any action approaching to the habits of the insane will be met with. In real insanity the person will *not* admit that he is insane; in the feigned state all his attempts are directed to make you believe that he is mad; and an impostor may be induced to perform any act, if it be casually observed to another in his hearing, that the performance of such an act will furnish strong evidence of his insanity.

I am indebted to a learned judge for the following note on feigned insanity:—'It may be safely held that a person feigning insanity will rarely if ever try to prove himself to be sane; for he runs the great risk of satisfying others that he is sane, a conclusion which he really desires to avoid. But there is no better proof, in general, that the insanity (supposing other evidence of it to be strong) is real, than keen eager attempts by the accused to prove that he is sane, and strong and indignant remonstrances against being held to be insane, although that would protect himself against trial and punishment. In a case which occurred at Edinburgh some years since, a doubt existed whether the person was feigning insanity or not. Those who were about him, and had charge of him in gaol, were satisfied, from his clearness and apparent coherence, that he was quite sane, and that what he exhibited was merely eccentricity or simulated attempts to act as a madman. Insane he certainly was, however, beyond all doubt; but he fought the point of his sanity most bravely in Court, and made very clear and quick remarks on the evidence of the medical men, who had no doubt of his insanity. When one physician of great experience with insane persons stated that he thought him quite incapable of giving information to counsel and agent for conducting his defence, he said instantly, "Then why did you advise me to apply to and see counsel and agents?"'

Mania is perhaps more frequently assumed than any other form, because the vulgar notion of insanity is, that it is made up of violent action and vociferous and incoherent language: but mania rarely comes on suddenly, or without some obvious cause. A maniacal patient is also equally furious day and night, while an impostor is obliged to rest after his violent exertions. Dr. Burrows recommends that close attention should be paid to the expression of the eye. The mobility of the features may be as rapid as the imagination is vivid; but when every feature may vary, or be kept under control and be steady, the eye will still indicate the erring thought—its expression cannot be easily assumed. There is about the eyes in mania a restlessness which cannot fail to attract attention; the patient sleeps but little, and the sleep is disturbed —an impostor sleeps as soundly as a healthy person. The violence of a maniac continues whether he is alone or not, while the impostor acts his part only when he thinks he is observed: hence the imposition may be detected by watching him when he is not aware that an eye is directed upon him.

In investigating a case, some stress has been laid on the fact that assumed insanity commonly appears suddenly and without probable cause; but while this may be allowed to have a general influence in forming a medical opinion, it is proper to bear in mind that the actual commission of a crime has sometimes suddenly led to an attack of mania in a previously sane person. Dr. Pagan has related a singular instance of this kind. Two men were committed to prison on a charge of theft, and the officers requested a poor man, who was a shoemaker, to assist them in conveying the prisoners. This man took a gun with him for better security. During the journey one of the prisoners leaped from the cart and ran off. The officers called to their assistant to fire, and he, thinking himself warranted to do so by their order, fired, and wounded the prisoner severely in the back and loins. The man who fired the gun was himself immediately committed to gaol as a criminal, and the event made such an impression upon him that he became violently maniacal, but it was supposed that he was feigning insanity. When scarcely recovered he was tried for the offence, convicted and sentenced to six months' imprisonment. ('Med. Jur. of Ins.' p. 82.) This case proves that a person may really be attacked with mania under circumstances in which a justifiable suspicion would be likely to arise that he was feigning. The feigning of monomania is a matter of some difficulty: it would be easily susceptible of detection. As in mania the part would be overacted, and an impostor would thus betray himself. Dementia is more easily feigned:—in general this state comes on slowly, and is obviously dependent on organic changes, as old age, apoplexy, paralysis, or hemiplegia; or it is a consequence of recurrent mania or monomania. As this form of insanity consists in an entire abolition of all mental power, so the discovery of any connected ideas, reasoning or reflection, either by language, writing, or gestures, would at once show that the case was not one of real dementia. Idiocy and imbecility could hardly be feigned successfully, because these are states of congenital deficiency, *i. e.* they must have existed from birth. Hence it would be easy to show, by reference to the antecedent life of a person, whether he has or has not always been such as he represents himself. The difficult cases of feigned insanity are really limited to those forms of the malady which are liable to attack a person suddenly. But for a sudden attack of real insanity there should always be some obvious cause :—the nonexistence of this, with the presence of a strong motive for deception, will justify a suspicion that the malady has been assumed.

The following case of feigned insanity was the subject of a trial in London some years since. A married woman aged fifty was charged with uttering a forged cheque :—she had craftily procured the signature of a person under a false pretence, and then forged his name to the cheque. When required to plead she made no answer, and appeared unconscious of the question. She took up some flowers placed in the dock, and crumbled them in her fingers, which were in continual motion. She stared wildly at times, changing her position,—turned her back on the Court,—muttered indistinct exclamations and made a humming noise. She was placed under some restraint in order to prevent her from jumping out of the dock. The first question which the jury was directed to try, was whether she was of 'sound mind or not,'—it being a rule of law that no insane person can be called on to plead to a criminal charge. Evidence was then adduced to prove that at previous periods of her life she had used incoherent language and was strange in her conduct. It was also shown that her mother, aunt, and sister had been insane. Dr. Uwins deposed that at first he thought the prisoner was feigning, for she appeared to be fully aware of the importance of the plea of insanity; but when he heard that other members of her family had had the disease, he was induced to think her insane, and not accountable for her actions. Another medical witness, who had attended her family professionally, and had known the prisoner long, thought she was not insane, although he allowed that the apprehension of a criminal charge might bring on an attack of insanity in a mind subject to aberration. Other witnesses deposed that they had never observed any acts of insanity about her; and it was further proved that she was well acquainted with the method of drawing and procuring money on bills. When arrested she tried to escape from the officer, and to conceal the money which she had procured by means of the forged cheque. The surgeon of the gaol thought she was feigning; he visited her daily, and he observed that her manner was changed so soon as she saw him. When asked what counsel she would employ, she returned a rational answer, saying that 'others would take care of that:' when charged with feigning she made no observation. She put on a wild look when she knew that she was observed, but when privately watched her behaviour was like that of a rational person :—she generally slept soundly. The jury found that she was of sound mind; she was then called on to plead to the charge, but she refused,—a circumstance rarely observed in the conduct of a really insane person; she was tried, and found guilty. There could be no reasonable doubt that this woman was an impostor, and that she feigned insanity well knowing what would be the result of the plea, if admitted. Two circumstances rather tended to complicate the case: 1st, the proof of hereditary predisposition; and 2ndly, her assumed silence, whereby she did not easily betray herself. In regard to hereditary predisposition, although valuable as collateral evidence, it cannot of course be allowed to outweigh general facts indicative of perfect sanity. This case proves the fallacy which is liable to arise from the unrestricted admission of such evidence.

At the Lewes Winter Assizes, Dec. 1856 (*Reg.* v. *Ball*), the prisoner, a ticket-of-leave convict, was convicted of housebreaking, and sentenced to fifteen years' transportation. The case of this man shows how easily medical practitioners who have had but little experience of insanity may be deceived by skilful impostors. After the prisoner had been committed to gaol he simulated madness so successfully that he deceived three of the visiting justices and two medical men; and a certificate was about to be signed for the removal of the supposed unfortunate lunatic to an asylum, when the deception was discovered by the impostor having made a confidant of one of his fellow-prisoners. He had been convicted of robbery at Leicester in 1851, and sentenced to ten years' transportation: he was sent to Millbank Prison, where he feigned insanity and succeeded in deceiving the medical officers there: they certified that he was a lunatic, and he was accordingly removed to Bethlehem Hospital, where he remained two years; he subsequently received a ticket-of-leave. For a singular case in which a verdict was returned against strong medical evidence of alleged insanity, see 'Lancet,' January 18, 1845, p. 70; also 'Med. Gaz.' vol. 47, p. 49; 'Journ. Psychol. Med.' 1848, p. 277; also 'Ann d'Hyg.' 1829, vol. 2, pp. 367, 376; 'Ann. d'Hyg. 1847, vol. 2, p. 230; and Casper's Vierteljahrschrift, Jan. and April 1864, pp. 50 and 225.

Appearances after death.—In some cases a medical practitioner may be required to state whether certain appearances found in the brain of a deceased person do or do not indicate the past existence of insanity or imbecility. Such a question is only likely to arise in chronic cases, in which the past existence of insanity from oral testimony may be disputed. (Case of *Stulz*, Prerog. Court, 1852.) The appearances commonly met with on an inspection of the head are—thickening of the bones of the skull, close adhesions of the dura mater (the lining-membrane), with great congestion of the pia mater, and opacity and thickening of the arachnoid membrane. (See Illustrations, p. 531.) There is a general fulness of the bloodvessels of the brain with remains of old cysts, hardened deposits, or even abscesses in various parts of the cerebral substance. Inferences from the existence of these appearances in the brain must be drawn with caution, because it cannot be said that they necessarily indicate insanity; nevertheless, such chronic changes must be considered as producing greater or less derangement of the mental functions; but the actual degree to which the impairment has existed ought properly to be determined by evidence of the conduct and actions of the deceased during life. In a communication made by Dr. Webster to the Medico-Chirurgical Society in April 1855, there is a statistical summary of the appearances met with in the examination of the bodies of 290 insane patients. In 226 cases the pia mater was infiltrated; in 207 effusion had taken place in the ventricles; in 184 fulness of the bloodvessels in the brain or membranes was observed; in 117 the arachnoid membrane was thickened and opaque; in 64 the colour of the brain appeared changed from its natural hue; in 51 the bloody points (*puncta cruenta*) were large and numerous upon the cut surface of the medullary substance; whilst in 40 instances blood was effused, sometimes to a considerable extent, within the cranium. This effusion had evidently been the immediate cause of death in most of the patients. From these data it appears that—first, infiltration of the pia mater; secondly, effusion of fluid in the ventricles; and thirdly, fulness of the cranial vessels, are the principal as also the most frequent diseased alterations of structure observed in patients who die whilst suffering under symptoms of mental disorder.

As neither the symptoms nor the duration of the insanity is given, it is difficult to apply these results to special instances. In the case of *Roberts* v. *Kerslake* (Warwick Aut. Assizes, 1854), the main question was whether certain appearances in the brain and its membranes did or did not indicate disease of long standing as well as insanity at the particular date at which a will was made. Dr. Conolly and I considered that the appearances were not inconsistent with the supposition that the testator was sane at the time of making his will. ('Journal of Psychological Med.' Oct. 1854, p. 573.) The reader will find some valuable information on this subject in a paper by Mr. Fisher ('Med. Gaz.' vol. 37, p. 657); and in another by Mr. Eccleston ('Med. Gaz.' vol. 47, p. 170); also in some contributions to the 'Journal of Psychological Medicine' (1850, p. 521, and 1851, pp. 236 and 383), by Mr. Holmes Coote. See also Dr. Jamieson's Lectures, 'Med. Gaz.' vol. 46, p. 652; and a paper by Dr. Webster, 'Journal of Psychol. Med.' 1849, p. 483; by Dr. Farre, in the same volume, p. 533; and by Dr. Hitchman, in the volume for 1850, pp. 228, 362, 501.

Statistics of insanity.—The tables of Esquirol show that the *age* at which insanity most commonly attacks persons is thirty; it rarely makes its appearance below the age of twenty, or above the age of fifty-five.

According to a report published by the Commissioners of Lunacy for 1850, there were in that year under their supervision, in England and Wales, 15,079 lunatics—namely, 7,074 males and 8,005 females. Of these, 11,305 belonged to the pauper class; and of the whole of the number, 7140 were confined in asylums. By their report, dated March 31, 1856, it appears that on January 1, 1856, the number of lunatics amounted to 20,764—namely, 9,701 males and 11,063 females. Of these, 20,643 are thus accounted for—there were in asylums, 13,823; in hospitals, 1,628; in metropolitan licensed houses, 2,591; and in provincial licensed houses, 2,601. On January 1, 1861, there were 24,845 insane persons confined in the asylums, hospitals, and licensed houses in England and Wales; on January 1, 1862, the number was 26,200; and on Jan. 1, 1864, they had arisen to 28,285 in asylums, private and public; and 16,410 in workhouses or lodged as boarders, making in all 44,695 persons of unsound mind. This is exclusive of the insane in gaols,—of Chancery patients living out of asylums, and cases kept out of view for private reasons. 'Med. Gaz.' vol. 46, p. 269, and 'Journal of Psychological Medicine,' 1850, p. 111.)

CHAPTER 82.

MEDICO-LEGAL QUESTIONS IN RELATION TO THE INSANE—IMPOSITION OF RESTRAINT—ILLEGAL IMPOSITION OF RESTRAINT—VIOLENCE OF TEMPER—CERTIFICATES OF INSANITY—RULES FOR THE DISCHARGE OF LUNATICS.

Among the questions which may come before a medical jurist in relation to the subject of insanity are the following:—A practitioner may be required to say whether a person affected with the malady should or should not be confined in a lunatic asylum,—whether he should be deprived of his civil rights by interdiction, or whether he be so completely cured of his malady as to justify his liberation from confinement. Then again medical evidence may go far to determine whether a will or deed executed by an alleged lunatic should be set aside; whether a marriage-contract or debt should be annulled; and lastly, whether a criminal act was committed by a person while labouring under insanity,—a question involving either the life or, according to circumstances, the perpetual imprisonment of a person accused of crime.

Imposition of restraint.—By restraint in a legal sense we are to understand the placing of attendants to watch or control the actions of an alleged lunatic, or his forcible removal from friends or relatives with or without the confinement of his person by physical force. What are the circumstances which will justify a practitioner in applying restraint to the insane? The law has given great power in this respect to members of the medical profession, but, owing to certain abuses, the power has been of late years much restricted by various Acts of the Legislature. Most medico-legal writers agree that we are not justified in ordering restraint except when, *from symptoms* witnessed by ourselves, we have reason to apprehend that *the lunatic will injure his person or property* or *the person or property of others*. It is then not sufficient to seek merely for evidence of the existence of some *delusion*, but to determine how far that delusion, if present, affects conduct. Unless the delusion be such as to render it probable that the patient's own interests or those of others may be damaged by his insane conduct, careful superintendence will answer all the purposes of the closest restraint. (For some remarks on this subject, see 'Med. Gaz.' vol. 44, p. 1061.) The act of resorting to restraint on all occasions has been justified on the principle that it may tend to the cure of a patient by removing his delusion. In this point of view the subject has reference to medical practice and not to legal medicine. It may be urged with more plausibility, that by withholding restraint in incipient cases, mischief may be done by the lunatic to himself or others, and that then it will be too late to interfere; but even here proper superintendence will render close confinement unnecessary.

The legal rule for the interference with the liberty of a person which restraint always implies, has been thus stated by Mr. J. F. Stephen:—'There is a normal state in which all human creatures act on the same principles, and the general meaning of sanity is, that the person conducts himself in this normal manner; that he is acquainted with the circumstances by which he is surrounded; that he has objects in view in his actions, and that he regulates his conduct with reference to them and to the general considerations which affect matters of that class.' ('General View of the Criminal Law of England,' pp. 87 *et seq.*)

It cannot be too strongly impressed on the mind of a medical man that, before he employs the powers conferred upon him by law to confine a person who is said to be mad, he should have well in his mind what lawyers imply by the term 'madness,' in a practical sense. As defined by Mr. Stephen, it means *conduct* of a certain character—not, as it is usually interpreted by medical men, a certain *disease* of the brain the existence of which is speculative, but one of the effects of which, if present, is to produce such conduct. In examining an alleged lunatic, with a view of determining whether he should or should not be placed in confinement, his conduct must therefore be compared with that of other men in a normal state; and here, in order to constitute sane behaviour, we must look for a generic and not for a specific resemblance. Any degree of ignorance, vice, or folly is perfectly consistent with sane conduct in a legal sense. The power of restraint is not intended to be applied to such cases as these; they are properly under certain circumstances amenable to the criminal law. An ignorant, vicious, or foolish man may do a great amount of mischief, but he has a liberty of choice and freedom of action; and if from folly or depravity he selects a bad course, he is not therefore insane, but is as much responsible for his actions as a sane man who prefers a good course. Such a man should not be treated as a lunatic or confined in an asylum under a medical certificate. It may be sometimes difficult to define the line which separates acts of depravity from those of insanity; but medical men have not been in many cases sufficiently cautious in endeavouring to make a distinction. Lawyers look closely to conduct as a ground of interference with personal liberty: the conduct must be such as to be inconsistent with the usual behaviour of a normally sane person placed under similar circumstances.

In examining a person proposed to be placed under restraint, we must take care not to confound acts depending on violence of temper with those which proceed from unsoundness of mind. A man may have always had a violent temper, subject to occasional fits of aggravation; but this condition must not be mistaken for mental disease. In order to determine whether the acts of a person be due to violent temper or insanity, it will be proper to ascertain what may have been his natural habits. The great feature of insanity is *change of character*—a man who is really insane is different from what he has previously been; but it may be proved of a violent-tempered man that he has always been the same. The greatest abuses of the restraint-system have been chiefly observed in respect to monomania, where persons have been forcibly imprisoned and confined in their persons, because they entertained some absurd delusions, over which, however, they had so great a power of control as to render it somewhat difficult even for a shrewd and experienced examiner to detect them. When at last, after many hours' cross-examination, the existence of a delusion has been made apparent, the result has been looked upon as furnishing matter for triumph and exultation; but, as Dr. Conolly justly remarks, one point in these cases appears to have been wholly lost sight of, namely,—What possible injury could have resulted to the patient or his friends from the existence of a delusion over which he had such complete control and mastery as to render it a most laborious task to obtain any evidence whatever of its existence? ('Indications of Insanity.') It may be freely admitted that where delusion does exist, there is reason to suppose that the mind must be more or less disordered in all its faculties; but such patients require only close watching, not a rigorous imprisonment in an asylum. The greatest danger is to be apprehended in all those cases where there is the least power of self-control.

The forcible removal of a person from his home to a lunatic asylum, unless the circumstances are of such a nature as to render immediate interference necessary on the ground of admitted or proved insanity, is unjustifiable in law, and may involve those concerned in the removal in a serious responsibility. The case of *Nottidge* v. *Ripley* (1849) is in this respect of some interest. A young lady of fortune was clandestinely and violently removed from a place to which she had voluntarily retired; she was examined by two medical witnesses nominated by those who had thus forcibly removed her; and then closely confined in a lunatic asylum for seventeen months. She was not allowed to communicate in any way with those members of her family who alleged that she was not insane, and who through these tortuous proceedings were for some time unable to discover the retreat of their relative, so as to have the case publicly investigated. At the trial for this abduction, the jury returned a verdict against the persons who were charged with the offence. ('Med. Gaz.' vol. 44, p. 974.) The allegation of insanity was denied, although it was proved that the plaintiff had fallen into the hands of men whose object was obviously to possess themselves of her property, and that, like her sisters, she had adopted some absurd pseudo-religious notions. If, however, such violent measures are sanctioned before any preliminary inquiry medical or otherwise is instituted into the state of a person's mind, and upon the mere opinion of non-medical persons or interested relatives, no person, whether sane or insane, could feel sure of his liberty. This case called forth at the time some criticisms which the reader will do well to peruse. (See 'Journ. Psychol. Med.' 1849, p. 564; and 1850, p. 14.)

In *Hill* v. *Philp* (Exchequer, Feb. 1852), an action was brought by plaintiff to recover damages for alleged neglect and unskilful treatment on the part of the defendant while under his care as a lunatic patient. The plaintiff was examined, and he wished to impress the Court that he was then perfectly sane.

His cross-examination, however, elicited the belief that 'he was descended from Leofric, the wise Earl of Mercia, who was contemporary with Edward the Confessor.' It was also proved that while in a tavern he had called for water from Jerusalem and the River Jordan! In short, there was abundant evidence of his insanity, and the jury properly returned a verdict for the defendant. The case, however, conveys an important caution that medical men should be careful in the imposition of restraint, as from the evidence it appeared that unnecessary violence had been used on this occasion. There is another circumstance which renders this case of interest to medical practitioners: it involved the question whether in the treatment of a lunatic, a medical man can justify the imposition of restraint by the allegation that he acted under the directions or upon the request of the wife or other relative at whose instigation the lunatic may have been confined. In *Hill* v. *Philp* the judges decided that a medical man under such circumstances may act upon the directions of a wife, but that the directions must be considered as only guiding his judgment, and not as absolutely dictating to him and justifying his proceedings; that he is still bound to exercise his own professional knowledge and discretion so far as to refrain from doing anything or adopting any course which might be injurious to the patient. A medical man is, therefore, ultimately responsible for his treatment of a lunatic: no person can give him authority to do that which is not in accordance with general practice or the necessity of the case. (For a report of this case, and some judicious remarks upon the decision, see the 'Legal Examiner,' May 29, 1852, pp. (307, 318.)

In *Scott* v. *Wakem* (Guildford Summer Assizes, 1862), the defendant, a medical practitioner, was sued for damages in placing under restraint, and without necessity or authority, a man labouring under *delirium tremens*. The plaintiff had been subject to attacks of this disease, and on the day in question the defendant was called to see him. He found him in an excited state with loaded pistols in his hands, threatening to shoot his wife,—and two men were holding him. He was then in a fit of *delirium tremens*, and in a dangerous state. The defendant placed a man in the house to watch him during the night. The usual medical attendant of the family saw the plaintiff on the following day, and then he found him quite sane and sensible, and complaining that he had been kept a prisoner in his own house by order of the defendant. Up to that time he had not seen the plaintiff for several months, and was therefore unable to speak to his condition on the previous night when he was placed under restraint. It was denied that any authority for interference had been given to defendant by the wife, although the evidence that she had authorized the proceedings was very strong. The plaintiff, who recovered next day, brought an action for damages. The charge of the learned judge (Bramwell, B.) in reference to the responsibility of the defendant was to this effect:—As to the law, if the defendant had made out that the plaintiff was, at the time of the original restraint, a *dangerous lunatic*, in such a state that it was likely *he might do mischief to anyone*, he would be justified in putting a restraint upon him, not merely at the moment of the original danger, but until there was reasonable ground to believe that the danger was over; and this would sustain one of the pleas. Or, again, if the jury were satisfied that the wife of the plaintiff had called in the defendant to cure her husband under a fit of *delirium tremens*, and that he came in to cure him, and left him when he believed he had recovered, then the defendant would be justified in what he had done, supposing that in either case he had done nothing that was not necessary or reasonably proper under the circumstances. Again, if the defendant had been called in on behalf of and for the benefit of the plaintiff, and to cure him under a fit of *delirium tremens*, and when the plaintiff recovered, he himself approved what had been done, that would likewise afford a defence, supposing that nothing more than proper treatment had been adopted. A verdict with a farthing damages was returned, but the medical man was necessarily put to great expense in defending the action. He had acted *bonâ fide*, as medical men ought to do on these occasions, under the belief that there was some imminent danger; but the learned judge observed, if he had done wrong in imposing restraint, he would not be justified on account of the sincerity of his belief. Had he declined to interfere, and the husband had shot the wife with one of the loaded pistols, he would have been severely censured for not having acted as he did. On one point this case suggests a caution to practitioners. The wife denied that she had given any authority for interference, and thus her evidence conflicted with that of the surgeon. Fortunately the facts were adverse to her statement; but in future cases of this kind, it would be desirable for the medical man to have a written authority for such proceedings, bearing in mind that he does not exceed what is necessary, proper, or usual for the treatment of the person; and on this he must always exercise his own judgment, irrespective of the opinions or suggestions of others.

Medical men, acting most conscientiously in discharge of their duties, cannot hope to escape harassing and vexatious actions when they are called upon to deal with cases of *delirium tremens*. The peculiarity of this disorder is that with the cause, it may soon disappear, and thus medical evidence may be easily procured to show that a person, at a short period before or after the imposition of restraint, was in a sane state of mind and not in a condition to justify any restraint of personal liberty. The case of *Symm* v. *Fraser* and *Andrews* (Queen's Bench, Dec. 1863) pre-eminently shows that no care or precaution in the performance of these reponsible duties will always suffice to prevent a medical man from suffering a large pecuniary loss in order to vindicate his professional character and conduct in reference to the insane. The plaintiff was a woman who gave way to habits of drinking; she had had an attack of *delirium tremens* two years previously to the trial. The defendants were called in, and attended her professionally. At her own request a nurse and a male attendant were provided for her by a friend, and they stated that they merely followed out the directions of the defendants regarding the plaintiff. She recovered, and after the interval of a year brought an action against the two physicians, not for negligence or ignorance, or want of due care and skill in treatment, but for assaulting and ill-using her, and putting her under personal restraint. It was affirmed that they were wrong-doers *ab initio*, and that there were no reasonable grounds to justify their proceedings. The trial occupied five days, and ended in a verdict for the defendants. The evidence is instructive as showing upon how slender a foundation an action of this kind may rest. There was no doubt that the plaintiff in this case had laboured under *delirium tremens*: every medical man who saw her described the symptoms to be those of this terrible disease—the restlessness, irritation, and excitement; the loss of sleep, the heat of the throat, the sense of suffocation, the aversion to lie down, the look of terror and the wild suffused eyes; the tremor in the limbs and even in the tongue, the distrust and dislike of all around, the disposition to talk incessantly, the thick voice and 'rambling way of speaking;' the attempts to run out of the house and even to get out of the window, the constant craving for drink, the violence towards those who withheld it; and, lastly, the tendency to delirious delusions.

If in any case temporary restraint was required, it would have been in this, and the verdict of the jury showed that the defendants were legally justified in resorting to it. One question raised was, whether they were responsible for the acts of the two hired attendants. It was proved that their presence had not been originally authorized by them, but it was suggested that there had been subsequent authorization of their proceedings. The learned judge (Cockburn, C. J.) here drew a distinction between the assumption of authority and the giving of instruction or advice as to what should be done: he also intimated that although nurses and attendants might not be originally appointed by medical men, yet if authority and command were assumed over them in reference to the management of patients, the medical men would be responsible for the personal restraint under which the patients were thereby placed. There had been, no doubt, some restraint on personal liberty in this case, but was it not necessary? The jury by their verdict justified the conduct of the physicians, and found that no more restraint had been applied by them then was actually necessary and reasonably required for the proper treatment of the plaintiff.

The case of *Hall* v. *Semple* (Queen's Bench, Westminster, Dec. 1862) presents on the other hand an illustration of the heavy responsibility incurred when proper precautions have not been taken before placing a person under restraint. This was an action against a medical practitioner for illegally causing the plaintiff to be seized and confined in a lunatic asylum. The question, however, mainly turned upon whether due care had been taken in signing the medical certificate by which plaintiff was forcibly carried off to a lunatic asylum. (See page 1065, *post.*) The evidence given by himself, his daughter, and neighbours established his sanity. The medical man at the asylum could find no indications of insanity about him on his admission, and the two Commissioners of Lunacy who examined him a few days after his admission ordered his discharge. It was proved that he had led a very unhappy life with his wife—that he was subject to fits of violent passion, and was of a somewhat jealous disposition. After a lengthened trial the jury returned a verdict for the plaintiff with 150*l.* damages. The evidence for the defence failed to prove that the plaintiff was labouring under any insane delusions in a legal or medical sense. The facts of this case show that any passionate ill-tempered man who lived on bad terms with his wife might, by the certificates of the wife and of two medical men, be illegally seized and confined as a lunatic. The evidence for the plaintiff, as given by his daughter, proved that there was great provocation on both sides, but no insanity. The regular medical attendant of plaintiff deposed that he had known him all his life, that he was quite sane, that he himself had been repeatedly asked by the wife to certify that her husband was insane, but he had never seen anything in the plaintiff's conduct to justify him in giving a certificate of insanity. This turned out to be one of those unfortunate cases in which too great reliance was placed upon the statements of a woman, who had an interest in and strong motives for the removal of her husband from the house. Had a reference been made in the first instance to his usual medical attendant, these proceedings would not have taken place.

In order to provide for the protection of lunatics and the prevention of undue violence or frequency in the application of restraint, the law compels the keepers of asylums to enter in a book a report of each case or of each occasion on which any mechanical restraint is resorted to. An omission to make this entry is a misdemeanour: and at the Maidstone Lent Assizes, 1851, two medical men were convicted and fined for placing patients under restraint without having made the proper entries required by law. (*Reg.* v. *Maddock*: see also 'Med. Gaz.' vol. 47, p. 556; and a paper on the 'Use and Abuse of Restraint', in the 'Journ. Psychol. Med.' 1849, p. 240.)

Certificates of insanity.—It will here be necessary to state the circumstances which require the attention of a practitioner when he is called upon to sign a certificate of insanity, whereby a person may be placed in confinement in an asylum. The Acts which specially refer to this subject are the 16th and 17th Victoria, c. 96 and 97. These Acts, which came into operation on the 1st of November 1853, are a consolidation of the statutes on the regulation of the care and treatment of lunatics. Their provisions are very stringent, both with respect to medical men who sign certificates, and those who keep asylums for the reception of lunatics.

According to s. 74. c. 97. no person (not a pauper) can be received into or detained in any asylum, without an order from some person (generally the nearest relative) and two medical certificates, which must be signed *by two physicians, surgeons, or apothecaries* not in partnership or an assistant to the other, and each of whom shall *separately from the other* have personally examined the person to whom it relates not *more than seven clear days previously* to the reception of such person into such asylum. These certificates need not be filled up, signed, and dated on the day of examination; but the examination of the patient must be made in every case *within seven clear days* before admission.

In *Hall* v. *Semple* (*suprà*) it was proved that plaintiff was admitted into an asylum on the 31st July, by a medical certificate dated on the 29th of that month, but the visit to the patient had been made on the 13th June. It was therefore invalid, and the person to whom it referred was ordered by the Commissioners to be immediately discharged: he had been improperly confined on an illegal certificate. It is a strange fact that, when rules are explicitly given in the Act of Parliament, medical men should be so negligent of a plain and simple duty as to sign certificates in direct contravention of the law. The examination of the patient in this case had been made more than six weeks before, instead of within one week of the date of the certificate. In June 1848 a surgeon was tried and convicted at the Central Criminal Court, of having certified that he had examined a female lunatic on the *day* on which he put his name to the document, when he had not seen her for two or three months. There was no doubt of the insanity of the party, but as this was an untrue statement, he was convicted of a misdemeanour.

The following is the form of a medical certificate in the case of private patients:—

I, the undersigned, being a (duly registered) physician *or* surgeon *or* apothecary [*here set forth the qualification*], and being in actual practice as such, hereby certify that I, on the day of , at [*here insert the street and number of the house* (*if any*), *or other like particulars*], in the county of &c., separately from any other medical practitioner, personally examined A. B., the person named in the accompanying statement or order, and that the said A. B. is a lunatic [*or* an idiot, *or* a person of unsound mind], and a proper person to be taken charge of and detained under care and treatment, and that I have formed this opinion upon the following grounds, viz.:—

1. Facts indicating insanity observed by myself [*here state the facts*].
2. Other facts (if any) indicating insanity, communicated to me by others [*here state the information, and from whom*].

(Signed) Name.
Place of abode.

Dated this day of , One thousand eight hundred and

Under s. 10. c. 96. no person can be received into any registered hospital or licensed house, or as a single patient, under any certificate which purports to be founded only upon facts communicated by others. A medical certificate may be amended if incorrect or defective. No medical man can receive as a boarder in his house any insane person, whether for medical treatment or otherwise, unless he has previously obtained a licence from the Commissioners of Lunacy, and one certificate duly signed by two other medical men. In January 1861 a medical practitioner was convicted of misdemeanour for thus receiving illegally a lunatic patient. (*Reg.* v. *Kelly*, C. C. C. Jan. 29, 1861.) This was a clear breach of the regulations. The defence was that he was ignorant of the law, but this was no answer to the charge. ('Med. Times and Gaz.' Jan. 28, 1861, p. 105; and 'Lancet,' Feb. 9, 1861, p. 151.)

Dr. Millar, who has had considerable experience as the superintendent of a large lunatic asylum, states that, as a rule, very few of the certificates which are brought with private patients are correctly filled up, notwithstanding the plainness of the instructions. The omission of particulars apparently of no importance has often caused them to be rejected as illegal; and it will therefore be useful to point out the chief errors which, according to this gentleman, are committed by medical men. 1st. A neglect in stating the qualification which empowers the medical practitioner to practise. It is not unusual for the blank space to be filled up with the words 'physician,' 'surgeon,' or 'apothecary,' instead of inserting the *qualification* which enables him to practise in any of these capacities. 2ndly. Omitting the address of the house at which the examination was made. In the case of *Greenwood* (page 1060) it was decided that this omission rendered the certificate invalid. If there should be no number to the house, it will be sufficient to state, 'At the dwelling-house of ——, in —— street, village, &c.' 3rdly. Omitting the address and occupation of the person examined. In nine cases out of ten, according to Dr. Millar, an omission, of one of these three simple and obvious particulars, occurs—a degree of carelessness not creditable to the profession. Medical men no doubt err from regarding them as having no bearing whatever on the sanity or insanity of a patient. (See Millar's 'Hints on Insanity,' p. 78.)

By s. 13. c. 96. a medical practitioner who gives a false certificate, or any person not being a registered physician, surgeon, or apothecary in actual practice, who gives certificates as such, is declared to be guilty of a misdemeanour. For any act done by a registered medical practitioner contrary to any of the provisions of the Act (although not declared to be a misdemeanour), he is subjected for each proved offence to a penalty of twenty pounds. By s. 36 the words 'physician,' 'surgeon,' or 'apothecary' shall respectively mean one duly 'licensed or registered to practise as such by, or as a member of, some College, University, Company, or Institution legally constituted and qualified to grant such authority or licence in some part of the *United Kingdom*, or having been in practice as an apothecary in *England or Wales* on or before the 1st day of August 1815, and being in *actual* practice as such physician, surgeon, or apothecary.' (16 and 17 Vict. cap. 96. s. 36.) Thus the certificates of Irish medical practitioners are valid for the confinement of lunatics in England, and conversely those of English practitioners are valid for asylums in Ireland. A special Act has been passed for Scotland (20 and 21 Vict. c. 71): and by sections 34 and 35 the rules regarding certificates are similar to those of the English statute.

Under the above-mentioned statute there is a technicality which it is desirable to point out, as it may affect the validity of a medical certificate. The Act expressly requires that the number of the house and the name of the street where the examination is made should be specified in the certificate, as well as the residence, profession, or occupation (if any) of the person examined. In *Re Greenwood*, which came before Mr. Justice Coleridge on a *habeas* for the discharge of an alleged lunatic (February 1855), the medical certificate for the confinement of this gentleman was set aside owing to an informality. There appears to have been considerable doubt about the state of his mind. Two physicians made affidavits that he laboured under unsoundness, while two others gave their opinion that he was mentally sound. The late Serjeant Wilkins then took an objection that, under the Act, the number of the house and the name of the street where the examination took place should be mentioned in the medical certificate; that had not been done in this instance, and Mr. Greenwood was not therefore in legal custody. Coleridge, J., in giving judgment, said:—'It was stated in the certificates that the examination had been made at Blackburn, but the examiners omitted to state the street; and the affidavit showed that Blackburn was a large and populous place. The statute prohibited the reception of any lunatic without medical certificates according to a form in the schedule to the Act, which directed the insertion of the name of the street and the number of the house in which the examination took place. It was not agreeable to decide on a formal objection when the defect had no influence on the merits, and that might be said in the present case; but decisions were precedents, and here the words were express: if one thing might be omitted so might others, and all the forms were with a view to the protection of a lunatic. If it were asked, of what benefit was such a particularity?—it might be answered that the Court had no business to consider that question, but the form might be a matter of importance in order to prevent improper examinations. He had come to the conclusion that the certificate was defective. If the party had been shown to be in a dangerous condition it would have been the duty of the Court to interfere. Upon the facts, Mr. Greenwood might be of most impaired memory, or might not be able prudently to govern a household; but it was clear he was harmless to himself and others—he would therefore be discharged.'

A medical practitioner must not be too ready to lend himself to the signing of certificates for the imprisonment of persons who may be labouring under harmless delusions. In violent mania, or in monomania with a homicidal or a suicidal propensity, there can be no doubt of the propriety of applying some degree of restraint, for here the necessity is imminent. If a remarkable change has suddenly taken place in the character of a patient,—if he has become irritable, outrageous, or threatened personal violence to any one,—or if he has recklessly endangered the interests of himself and family, he is undoubtedly a fit subject for restraint. (See 'Pagan,' p. 75.) The more he approaches to this condition, the less difficulty we shall have in coming to a decision, and in a really doubtful instance there will be no impropriety in employing restraint; since, although the person is thereby deprived of liberty, it is better that this should happen than that he or his friends should incur the risk of suffering severely by his insane conduct.

The 74th section of cap. 97 provides that in cases of emergency a person (not a pauper) may, under special circumstances (these being stated in the order), be received into a house or hospital upon a certificate signed by *one* medical practitioner only, provided that within *three days* two other such certificates are signed by two other medical practitioners not being connected with such house or hospital, upon a like examination. The detaining of a person upon one medical certificate only beyond the period of three days, without such further certificates, is a misdemeanour in the keeper of the house or hospital. By s. 67. c. 97. the certificate of *one* medical practitioner only, signed according to the above rules, will suffice for a *pauper lunatic*, provided the person has been previously examined by a justice, clergyman, and overseer or relieving officer. By s. 12. c. 96. no medical practitioner who is interested in or attends a licensed house or hospital, or whose father, brother, son, partner, or assistant is wholly or partly the proprietor of, or a regular professional attendant in, such house or hospital, shall sign any certificate for the reception of a patient into it. It is obvious from the terms of the Act that one person cannot sign a certificate as a substitute for another, and yet there have been several instances of its violation under these circumstances. In December 1855 a medical assistant was committed for trial because he had signed the name of the surgeon with whom he was living to a certificate of insanity for the confinement of a pauper lunatic. There was no doubt about the insanity of the person, and the plea urged in defence was that the surgeon whose name was thus forged was in ill-health, and had given the assistant an authority to sign papers for him. This, however, was no justification of a violation of the terms of the Act: the words of the certificate are so explicit on this point that no reasonable person can have any doubt about their meaning.

As ignorance of the law is not allowed to be an excuse for its violation, so a medical man, unless acquainted with all the particulars above mentioned, may easily subject himself to a prosecution or a civil action; and he is not likely to be spared the disgrace and mortification attendant upon either, should it happen that the case is of a doubtful nature. The law expressly requires from each medical man a separate visit, a separate personal examination of the alleged lunatic, and a separate medical certificate setting forth the *special fact or facts* (whether observed by himself or derived from the information of others) upon which his opinion is based. Dr. Conolly has shown that there are objections to the severity of the restrictions regarding these certificates ('Journal of Medical Science,' April 1861, p. 127), but some recent cases have shown that they are not strong enough to prevent sane persons from being wrongfully sent as lunatics to asylums.

Specification of facts.—It will be observed that every medical practitioner signing a certificate of insanity is required to specify the *facts upon which his opinion is formed*, and whether such facts are derived *from his own observation* or from the information of any other person. Medical practitioners have had some difficulty in performing this duty, *i.e.* in assigning the fact or facts upon which their judgment of the insanity of a person is based. ('Med. Gaz.' vol. 36, p. 1434; and vol. 37, p. 485.) What will constitute the description of a fact to render a certificate valid? This important question was raised and decided in the case of *Shuttleworth* (Queen's Bench, Nov. 17, 1847). An application was made for the discharge of a lunatic on the ground that the medical certificates did not set forth the *facts* from which the opinion of those who signed them was derived. In one it was stated that the lunatic laboured under a *variety of delusions*, and that she was *dirty and indecent in the extreme*; in the other the certifier stated that he had formed his opinion from the *conversation* which he had that day had with her. It was contended that the statement in the first certificate was not so much a fact as a conclusion drawn from other facts, which ought to have been mentioned in the certificate itself. Lord Denman, in giving the judgment of the Court, held that the certificates were valid—that it was not necessary to have all the delusions of an insane person stated in the certificate. The statement that the lunatic was dirty and indecent in the extreme was *primâ facie* sufficient to justify the imputation of insanity, even if the certificate did not state that the patient laboured under a variety of delusions: the allegation that the opinion respecting insanity was founded upon a conversation with the alleged lunatic was also sufficient to render the certificate valid. ('Med. Gaz.' vol. 38, p. 932; also 'Law Times,' Nov. 21, 1846, p. 145.) Hence it follows that a general statement of the circumstances which have led to the belief in the insanity of a person, will be a sufficient compliance with the requirements of the statute to render a certificate valid, provided the examination has been made *bonâ fide* and with due care and attention.

Dr. Millar has shown how little the words 'Facts indicating insanity observed by myself,' are appreciated or even understood by many medical men, who are legally empowered as registered members of the profession to sign these certificates. The facts are frequently stated in a loose and careless manner, showing a complete misapprehension of their meaning. What is really required by the law is a statement of facts observed or witnessed by the medical man himself, which would carry conviction to the mind of any non-professional man reading it, that the person to whom it referred was of unsound mind. A medical man should in all cases avoid giving as a fact indicating insanity, any delusion which might in reality have some foundation in truth. With respect to the second requirement of the statute,—namely, 'Other facts (if any) indicating insanity communicated by others,'—it may be observed that, although these do not supersede the facts observed by the medical man himself, they are of great importance in throwing light upon the propensities or habits of the patient, and thus serve as a guide for treatment. (Op. cit. p. 79.) A medical man must take care to draw a clear distinction between the facts observed by himself and the facts communicated to him by others, and avoid such vague expressions as that he 'thinks' and 'believes,' &c.

Dr. Millar gives a series of 'facts' taken from certificates of patients who have been brought to the asylum of which he is superintendent. Some, he remarks, afford no evidence whatever that the person to whom they refer is of unsound mind; others are vague and irrelevant; and, lastly, there are some which are quite satisfactory:—

'1. *Those facts which offer no evidence of insanity.*—(In reference to these certificates, it may be remarked that they were all sent back to be amended, as the patients could not be received under them):—

'Refuses to take her medicine, and resists in every way; closes her teeth, and threatens to strike any one near her; obliged to use the strait-waistcoat.'

'Violent in her temper and very abusive.'

'She refuses to answer questions as to where she lives; her memory is much impaired; she is weak, and has an appearance of imbecility.'

'He is very bad-tempered; and imagines he is coming into some property.'

'Look and manner indicate imbecility; memory very defective; can give but little account of himself; does not know his own age.'

'He has a suspicious, dangerous, suicidal eye; he evidences in his appearance cerebral mischief.'

'Great excitability from religious delusions.'

'Moody irritable temperament, and of weak memory in many particulars.'

'General conduct for the last three months; sleeping on the coffin of his wife three months ago; general obstinacy and delusions of various kinds; extreme excitement at times; this day he appears much more rational and quiet.'

'She has an insane appearance, and wanders about apparently without object; she is anasarcous.'

'An insane appearance; loss of memory; she is subject to epilepsy; has been under my care for some time, and has never until yesterday been in any way violent or troublesome.'

'He imagines he has no other clothes to put on besides his present habiliments; he imagines he is about to come into some property.'

'2. *Vague and irrelevant facts.*—Obstinate; has the manner and appearance of an insane person; complained of her head; refused her food, and would not go downstairs; melancholy.'

'She states she had a child which is dead, but which is now living.'

'She is suspicious of her husband without cause; says he keeps bad company; she is most irritable and jealous, and takes stimulating drinks to a dangerous and exciting extent.'

'His countenance is expressive of great anxiety and restlessness; his pulse exceedingly feeble—he appears to have been bled; he says all the public-houses in London belong to him; also that he is going to marry the Queen.'

'She is very good-tempered, but day and night she talks almost incessantly, occasionally sings; she says she comes from Otaheite, and relates stories of those around her doing absurd things.'

'This patient has old bronchitis, and is very weak; her memory is almost lost; she believes her mother is still alive, and gives me messages to people long since dead; at times she is noisy and excitable, and is generally very loquacious.'

'His unreasonable and inconsistent conversation.'

'That, being a married woman recently confined of her first child, she persists that she is not married, and is under delusions that she has committed some great sin; she is melancholy, seldom speaking when spoken to, and almost totally refusing her food; and constantly attempting to beat herself, requiring to be kept under restraint.'

It turned out that this woman was really not married.

'He has imperfect sight, good hearing, and taste; he is unable to speak; his gait is ape-like; and the skull-bones seem to have fallen together, from the want of cerebral development. He will occasionally slap his face and strike his hands, and sometimes make a howling noise.'

'3. *Good facts.*—That she is in a state of restlessness and excitement, and generally incoherent in her conversation and conduct. Thus, stating her place of abode to be twenty-five miles from Hertford, when it is only two miles; that her doctor resides in Fore-street, Cripplegate, and goes to Hertford to see her every day, when, in fact, he resides in Hertford and sees her only now and then; that her uncle farms 3,000 acres of land in one farm, besides several others, when, in fact, he farms only 150 acres; and that all her conversation is without rational sequence of ideas, passing rapidly from one thing to another; that, whilst I was conversing with her, she began to undress herself, apparently without purpose.'

'She states that she is a lost person, and without hope of forgiveness; that she will be taken to prison, and die a miserable death; that the devil whispers in her ear that she has committed the unpardonable sin.'

'From desperate attempts at self-destruction from groundless fears of poverty.'

'From the delusion that all the food brought to her is poisoned, and refusing to take any; that she has cats and dogs in her stomach and about her room, and expressing a desire to commit suicide.'

'Great taciturnity; complete seclusion from society; aversion to cleanliness, and having no fixed ideas about anything; wandering about the streets at improper hours.'

'*Of an old man aged* 83.—Mental and moral incapacity, and perverted feeling and views with regard to women and female children; personal habits uncleanly and slothful.'

'Inability to hold any rational conversation; her manner and conduct totally at variance with her usual habits.'

'He states that he is a Prince of France; that he possesses a palace, and has recently had two fortunes left him—one of 400,000*l.*, the other of 600,000*l.*; that he is going to Liverpool, a distance of 160 miles, with a horse and cart, which will take him four hours to go, and eight to return.'

'From his being subject to epileptic attacks, followed by incoherence, and occasionally uncontrollable violence.'

'He is incapable of judging between right and wrong; and is in such a state of mental debility, that he does not recognize persons who are closely related to him, and who have recently been with him.'

'Violent excitement, with rapid, incoherent, and obscene speech.'

'That she is outrageous in her conduct and incoherent in her statements; when questioning her upon rational subjects, she immediately became very violent, rushing downstairs in a state almost of nudity, and locking herself up in the coal-cellar.'

'He fancies himself to be a large shipowner, and offers those about him the command of his ships; he is also incoherent and violent.'

'A general restlessness and perturbed manner. When asked to sit down, he says, "I can't sit down;" to put out his tongue, "I can't put out my tongue;" if he eats his food, he replies, "he can't eat food; he can't swallow; that he has no throat; that he never eats anything; that his feet are broken, and his hips are broken—that he is altogether broken." He lies in bed, and when asked to get up, he says, "I can't get up;"—all of which sayings are delusions, and not true. He does get up, and he does sit down; and he does eat, drink, and sleep; and his feet are not broken; nor has he received any injury to his ribs or hips.' (Millar's 'Hints on Insanity,' 1861, pp. 80-86.)

As every medical certificate, although accepted by the Commissioners of Lunacy, may become at a future time a subject for close and hostile criticism in Court, a medical practitioner should be fully prepared to justify the use of the terms which he has employed. It is therefore desirable that he should studiously avoid any misstatement or exaggeration of the symptoms. One of the facts cited as indicative of insanity in an old lady was, that she kept a cockatoo! In the case of *Davies* the teadealer, Lord Brougham, then a counsel at the bar, retained to oppose the Commission against the alleged lunatic, elicited from one of the witnesses, as a fact upon which he relied to indicate insanity—that when asked the question, Mr. Davies did not know how much change he had in his pocket! Another relied upon the fact as indicative of weak mind, that the alleged lunatic had said he preferred seeing the people come from Epsom races rather than the racing on the course! Vague and trivial facts which do not indicate insanity, naturally tend to produce a feeling in the minds of the jury the very reverse of that for which they are brought forward. Thus in this case, although there could be no doubt, from what subsequently occurred, that Mr. Davies was a lunatic and a fit and proper person to be placed under restraint, yet the eloquence of Lord Brougham, and the result of a skilful cross-examination in bringing into prominence the weakness of the facts on which the witnesses relied to establish insanity, had such an influence with the jury that they returned a verdict in favour of the lunatic, and for a time he was considered as the unhappy victim of an unjust persecution on the part of his mother and other relatives. In a case referred to by Dr. Bucknill, one of the medical men certifying to the insanity of a gentleman, who was at that time undoubtedly insane, had stated as facts *observed by himself*, that 'his (the patient's) habits were intemperate, and that he had squandered his property in mining speculations.' But on cross-examination in the Queen's Bench, he was obliged to confess that the only act of intemperance he had actually observed was the patient's drinking one glass of beer, and that the squandering of property was the loss of what was to him a mere trifle in a mining speculation, which eventually turned out to be a very good one. (Millar's 'Hints on Insanity,' 1861, p. 187.) Counsel properly hold a medical practitioner strictly to the common and accepted meaning of the words which he uses.

No professional man is compelled to take upon himself the responsible duty of signing certificates of insanity; but if he does undertake it, he must perform it with reasonable care and ordinary skill. If he certifies that a person is labouring under delusions, he must take care that he understands the meaning of the term; and, admitting that he is correct in believing from his own observation that they exist in the mind of the patient, it must be remembered that, in order to justify restraint or imprisonment in an asylum, the law looks always to the influence of these delusions upon conduct. The case of *Hall* v. *Semple* is in this respect most instructive to medical men (p. 1057). One of the charges against the defendant was, that the medical certificate signed by him was false and untrue. Two certificates were issued, one by the defendant and the other by another medical man, in the usual form; and the *facts* on which the conclusion respecting the insanity of the plaintiff was based, were thus set forth in the first medical certificate:—

'1. Facts indicating insanity observed by myself:

'He had a wild and staring look, with restless eyes, and nervous agitated manner. He represented to me that his wife was ruining himself and business, and he intimated that she was improperly associating with other men; he is evidently labouring under delusions, and he acts upon those delusions.'

'2. Other facts (if any) indicating insanity communicated to me by others:

'He is guilty of repeated acts of violence; he constantly threatens his wife, and often assaults her; he sleeps with a drawn sword by his bedside, and declares he will murder any one who approaches him, and he has often threatened to stab his wife.'

The second medical certificate was as follows:—

'1. Facts indicating insanity observed by myself:

'He had a restless, irritable, and excited manner, with a wild and glaring look, and expressed much vindictiveness towards his wife, and said, "I must be a —— fool to mind what that woman has said!" He stated that she had her fellows continually running after her, and intimated that I was one of them.

'2. Other facts (if any) indicating insanity communicated to me by others:—'On a former occasion when I had called to see him he had just before broken the looking-glass to pieces, also the marble mantelpiece and bedstead; had been brandishing knives over his wife's head, and using horrid language; sometimes kicking her, tearing her bonnet and clothes off, and all without provocation, as I find from neighbours and old acquaintances that she is a discreet, sober, prudent, and patient woman.'

It will be observed, by comparing these 'facts' with those above given by Dr. Millar, that they belong to the class which are vague and which offer no evidence of insanity. The facts were chiefly obtained from the wife, on whose statements the defendant placed strong reliance. The cross-examination of the medical gentlemen who signed these certificates failed to support their views that plaintiff was or had been insane, or in a state of mind to justify his removal by force from his home. No regular examination of the plaintiff had taken place, and it came out in evidence that some of the so-called delusions had a foundation of truth. In fact, it was conclusively proved that the quarrelsome husband of an equally quarrelsome wife had been confined as a lunatic at the instigation of the wife, and that for some years she had been unsuccessfully attempting to obtain certificates of his insanity from medical men; but they very properly refused to sign them. There was, apparently, as much reason for confining the wife as for confining the husband. The medical man who signed the second certificate defined the plaintiff's insanity to consist in 'diseased feelings,' likely to lead to violence and murder, and 'manifested by a disinclination to see his wife comfortable!' But, as it was remarked by the judge, 'A man might detest and hate his wife very much, and be guilty of brutal conduct towards her, and yet not be insane.' In addressing the jury he said:—'It is plain there was great bitterness on both sides; and it is clear that the wife had for some years been trying to get rid of her husband by having him put into a lunatic asylum, and that the certificates of insanity arose from her suggestion. Sometimes a mere examination of the person may be sufficient; but the history of a case, where it is one of doubt or difficulty, is always of the greatest importance; and here particularly so, for the defendant himself stated that on a mere examination of the patient, he could not come to a conclusion without further inquiry. It is said that his opinion was ultimately founded principally on the supposed existence of delusions. A delusion, of course, does not mean a mere mistake of fact. Hundreds of people may have notions, that their friends have injured them or their wives deceived them, not founded on fact, and yet these are not delusions, as we now use the word. By delusions we understand ideas fixed in the mind without anything to lead any rational being to entertain them. These delusions often accompany insanity, and so are taken to be *indicia* of insanity; and in this case, no doubt, it is extremely important, when so much stress is laid on "delusions," to make up our minds first whether they had any real foundation in fact. Now, I should very much doubt the case of the defendant if it rested on his examination of the plaintiff alone. It was a very short one, and he himself said it led him to no certain conclusion; and what took place at it is doubtful, as the plaintiff and defendant gave contradictory evidence about it. It is agreed he was not there above ten minutes. You will consider what took place on this occasion; but what strikes me is, that at the end of it, the defendant states he was not satisfied and had not made up his mind. It would be culpable negligence on his part if he did not make due enquiries.'

In reference to the important question of medical responsibility, the following observations occur in the charge:—'The true ground of complaint is the negligence of the defendant and the want of due care in the discharge of the duty thrown upon him; and I think that if a person assumes the duty of a medical man under this statute, and signs a certificate of insanity which is untrue, without making the proper examination or enquiries which the circumstances of the case would require from a medical man using proper care and skill in such a matter,—if he states that which is untrue, and damage ensues to the party thereby, he is liable to an action, and it is to that I desire to direct your particular attention. In point of law, if a medical man assumes under this statute the duty of signing such a certificate, without making, and by reason of his not making, a due and proper examination and such enquiries as are necessary, and which a medical man under such circumstances ought to make and is called on to make, not in the exercise of the extremest possible care but in the exercise of ordinary care, so that he is guilty of culpable negligence, and damage ensue, then an action will lie although there has been no spiteful or improper motive, and although the certificate is not false to his knowledge.'

The jury found a verdict for the plaintiff,—that the certificate was untrue in effect, and that it had been signed without proper examination and enquiries and without probable cause.

Discharge of lunatics.—In forming an opinion relative to the propriety of discharging a person who has once been confined as a lunatic in an asylum, it is proper to examine the particulars of his case with the same caution as if the object were to confine him for the first time. The question of liberation is commonly restricted, like that of restraint, to cases of mania and monomania. It may so happen that an individual has a lucid interval at the time of examination, in which case it will be necessary to make more than one visit. One who has been guilty of a heinous crime like murder should never on any pretence be discharged. There are often long lucid intervals in homicidal mania, and it is impossible to be certain that the disease is entirely removed. If the person has manifested the least disposition to suicide, we should be extremely cautious in liberating him: for suicidal mania is often artfully concealed under a cheerful exterior. We cannot always test the propriety of granting liberation by the lightness of the offence for which a criminal lunatic has been confined. The circumstances under which the most trifling offence has been committed, may show that the mind is wholly unsettled with regard to moral responsibility: and such lunatics can never be trusted, even when there is a great improvement in their language and deportment. The unhappy result of prematurely discharging a criminal lunatic was seen in the case of a man named *Thom*, otherwise styling himself Sir William Courtenay. He was shot while rioting with many others near Canterbury, in June 1838. The whole life of this man seems to have been made up of a mixture of eccentricity and insanity. He was guilty of the most flagrant perjury—was tried, found insane, and confined as a lunatic. After the lapse of about six months it was thought that he was so much improved as to allow of his discharge, although even at this time it appears that he fancied himself to be the Saviour! On his discharge he was guilty of many extravagant acts; he collected a number of ignorant persons as his followers, and infected them with his delusion. He resisted the military who were sent to apprehend him, and eleven lives were lost on the occasion! Dr. Forbes Winslow relates that a man was confined in an asylum while suffering from a delusion respecting the fidelity of his wife. For many months this idea was uppermost in his mind, and appeared to absorb all his thoughts. At the expiration of eight or nine months he appeared to be much improved in bodily and mental health, and the delusion had apparently less hold of his imagination. Eventually he cunningly declared that his mind was quite at ease respecting his wife, and that he no longer believed that she had or could have been unfaithful to him. Under a mistaken impression that he had quite recovered, the patient was discharged from the asylum and permitted to return home. In about a week or ten days afterwards he murdered his wife and child, believing that the former had committed adultery and that the child was not his own. For several days after joining his family he appeared quite well, so clearly and effectually did he mask his lunacy from those immediately about him. ('Obscure Diseases of the Brain,' p. 215.) A medical man cannot always be responsible for unfortunate consequences of this kind; but these and other similar instances show that great risk is incurred in hastily allowing the discharge of a lunatic who has once been guilty of a crime, however slight, so palpably depending on a disordered mind.

The 16th and 17th of Victoria, c. 97, has placed certain restrictions on the power of liberating lunatics. Under ss. 83 and 84, the person originally signing the order which is required in addition to the medical certificates, may write an order for the discharge or removal; but under s. 85 this order is of no effect, if a medical practitioner certify that in his opinion such patient is dangerous and unfit to be at large, together with the grounds on which his opinion is founded, unless the Commissioners or Visitors shall, after the production of such certificate, give their consent in writing for the removal or discharge of such patient. Under other clauses, additional powers of discharge are given to the Commissioners and Visitors, subject to such restrictions as to leave the control for the most part in the hands of professional men. These powers of discharge do not, however, apply either to criminal lunatics, or to those found insane under a Commission issued by the Lord Chancellor.

CHAPTER 83.

TESTIMONIAL CAPACITY OF LUNATICS—INTERDICTION—COMMISSIONS OF LUNACY—EXAMINATION OF ALLEGED LUNATICS—MEDICAL AND LEGAL TESTS OF COMPETENCY.

Testimonial capacity of lunatics.—A question of some importance has arisen regarding the admissibility of the testimony of lunatics concerning facts which they allege they have witnessed. According to Mr. Fitzjames Stephen, madmen in respect to competency as witnesses are precisely on the same footing in relation to testimony as in relation to crime. If they understand the nature of an oath, and the character of the proceedings in which they are engaged, they are competent witnesses, whatever may be the nature or degree of their mental disorder. (‘Criminal Law of England,’ p. 288.) As ancient legal dicta on this subject, we find the following:—‘An idiot shall not be allowed to give evidence (Co. Litt. b. 6; Gilb. Evidence, p. 144) nor a lunatic (Ib.) except during a lucid interval’ (Archbold, ‘Pleading and Evid. in Crim. Cases,’ p. 124); but it is now known and admitted that the shades of insanity are infinite,—that some lunatics are as fully competent to observe and remember facts, and to understand the obligations of an oath, as persons who are sane; hence, therefore, incompetency to give testimony must not be inferred from a mere name assigned to the malady under which a person is labouring, but it must be decided by the special condition of the lunatic. Under any other view, crimes of the greatest enormity might be perpetrated in lunatic asylums without the possibility of convicting the offenders. It has been appropriately remarked by a good authority, that the fact of incompetence to testify is not necessarily connected with a state of insanity; and it would be far more correct to consider it an independent fact to be established by a distinct order of proofs. The truth is, an analogy in a medico-legal sense has been too hastily assumed between the act of testifying and that of performing business-contracts and other civil acts; and, in consequence, it has shared with them in the same sentence of disqualification without an attempt to ascertain the kind and degree of intellectual power which they respectively require. (Ray, ‘Medical Jurisprudence of Insanity;’ and ‘Medical Gazette,’ vol. 47, p. 150.)

In the case of *Reg.* v. *Hill*, tried at the Central Criminal Court in the spring of 1851, the evidence of a man named Donnelly was tendered on the part of the Crown. (‘Jour. of Psychol. Med.’ 1851, pp. 279 and 436.) This man was a pauper lunatic, and was confined as such in the same ward with the deceased, who it was alleged had been maltreated and killed by the prisoner. It was quite clear from the cross-examination of Donnelly at the trial, that he laboured under insane delusions that he was constantly visited by spirits, &c.: but, nevertheless, he gave a clear and consistent account of the mode in which deceased was maltreated by the prisoner; and although he professed his firm belief in the existence of spirits and their secret power of communicating with him, he appeared to have a full knowledge of the difference between truth and falsehood. His evidence was received, and upon this the prisoner was convicted. The case was subsequently argued in the Exchequer Chamber before all the judges, and decided in favour of the admissibility of the evidence. It may now therefore be considered as settled, that a lunatic who labours under delusions, but who in the judgment of a medical practitioner is capable of giving an account of any transaction that happened before his eyes, and who appears to understand the obligation of an oath, may be called as a witness. (*Reg.* v. *Hill*, ‘Denison's Crown Cases’, 2, p. 254.) The rule laid down by Baron Parke is in accordance with this view: it is for the judge to say whether the evidence of the witness is admissible, and then his credibility is a question for the jury. In the spring of 1852 I saw Donnelly, the witness in the above case, in the Colney Hatch Lunatic Asylum; his powers of observation and reasoning were then very acute and quite sound, except when reference was made to his peculiar delusions regarding spirits.

In another case, on appeal at the Middlesex Sessions in December 1852, the testimony of a lunatic was tendered on the part of the respondents, but objected to on the ground that his insanity rendered him incompetent as a witness. The Assistant Judge then said:—'I have had a consultation with Mr. Baron Parke, and I confess I look with fear at what may be the ultimate consequences of the law on this subject. This is the course to be adopted:—the witness who is tendered is first to be examined on the *voir dire*, and then he is to be cross-examined; witnesses may be called on both sides to show his competency or incompetency; and it will then be for the Court to judge whether he should be admitted as a witness, and if it is decided in his favour the man may be examined. In fact, the Court become Commissioners in Lunacy. Now, whatever might have been the state of his mind before all this takes place, supposing the lunatic even to be competent to give evidence before this examination and cross-examination, I should think that anybody who has visited lunatic asylums, or knows anything about persons of insane mind, would agree with me that the chances are that his mind will be so overbalanced as to render him unfit to give evidence afterwards. When this was argued on a former occasion, a case was mentioned in which a man was acquitted upon a charge of murder on the ground of insanity, and another man (while the lunatic was in prison, subject to Her Majesty's pleasure) was committed to the same prison charged with another murder. He made a confession to the first man, and it was proposed on the part of the Crown to call this man, who was acquitted because he was insane, to give evidence of the confession that the sane man had made to him; and after an argument the learned judge who presided was about to give permission for him to give evidence, when the foreman of the jury said:—"My Lord, I do not know what your Lordship means to decide, but I think it right to tell you that the jury will not believe a word he says." Upon this the witness was not called.'

It was then proposed by counsel to call a medical gentleman under whose care the lunatic had been. He would state his competency to give evidence, and he should then put the witness in the box, and the learned judge would remember that on the last occasion the witness was perfectly conscious of all that was going on, although a little irritable. The Assistant Judge observed, that it was an important question; for he supposed that now in appeals against lunatic orders the lunatic himself would be frequently produced as a witness. He would only say, generally speaking, that he hoped no man would ever be brought from any asylum to be examined, without the principal medical officer of that asylum accompanying him in order to speak to the state of his mind.

Dr. Huxley, resident medical officer and superintendent of the Kent County Asylum, under whose charge the lunatic was, was then examined, and gave as his opinion that he could speak correctly to facts that occurred before he became insane. A witness came forward and spoke to the accuracy of the statements contained in a paper written by the man. The lunatic was then himself called,—examined by the judge and cross-examined on the *voir dire*. The Assistant Judge decided that he might be sworn and admitted to give evidence, which was done, and he proved the facts of the respondents' case. Having heard his examination, the Court had no doubt that they ought to believe him; the witness had evinced considerable power of memory.—*Order confirmed.*

In *Reg.* v. *Coggle* and *others*, tried before Lord Campbell at the Nottingham Lent Assizes of 1856, the evidence of a lunatic was received on a trial for felony. The prisoners were charged with highway robbery, and the prosecutor could not clearly speak to their identity. A man named Bourne witnessed the transaction and swore positively to two of them. Previous to the trial, however, this man was attacked with insanity, and at the time of the trial was confined in an asylum. He was produced as a witness, and gave his evidence in a clear and calm manner. It was received, and upon it chiefly the prisoners were convicted. In *Reg.* v. *Slater* and *Vivian* (C. C. C. Sept. 1860) the evidence of two lunatics was received, but their statements were uncorroborated, and the jury by their verdict rejected their evidence (p. 1031).

Interdiction. Commissions of lunacy.—By interdiction we are to understand the depriving of a person labouring under mental disorder of his civil rights; in other words, preventing him from exercising any control or management over his affairs. It may be with or without restraint, for one condition does not necessarily imply the other, although there is a popular idea to the contrary. In *Re Smith* (June 1862) an order for a jury was issued to try the question of sanity or insanity, and in affirming the order Lord Justice Knight Bruce enunciated the following proposition:—'It is desirable to remove the idea, but too generally entertained by persons (common persons) in different stations of life, that the finding by a jury that a person is of unsound mind necessarily involves an interference with his personal freedom: it does not. The Court places no further restraint upon a lunatic than is necessary for his protection, and I would refer to the fact that there are several lunatics living under the protection of the Court who reside in their own houses with large establishments.'

When a person, from mental incompetency, is liable to be imposed upon by others, or is guilty of foolish and extravagant acts, whereby his property is damaged, a Commission is commonly granted by the Court of Chancery, in order to determine whether he be '*compos*' or '*non compos mentis*.' This writ is well known under the name of '*de lunatico inquirendo*.' Before it can be issued it is necessary, among other matters, that there should be affidavits made by two or three physicians or surgeons, certifying to the insanity of the party. It has been already explained that the object of the Commission is to determine whether the incapacity to manage affairs is owing to some *mental* defect or disorder, and not merely to want of education or bodily infirmity—otherwise all wealthy minors and infirm persons might be improperly deprived of the control of their property. Formerly Commissions were not issued unless it was evident that lunacy or idiocy existed—for weakness of mind or imbecility was not considered sufficient to justify legal interference. This is no longer the case, 'unsoundness of mind with incompetency' being all that the law requires to be established. Thus then, whether the case be one of mania, monomania, or dementia is not now the question, but whether the party be *compos* or *non compos mentis*: if the latter, whether it be to a degree to prevent him controlling his property with careful and provident management. There was a strange contradiction in our system of jurisprudence some years ago. A person who had a delusion on a particular subject, although not affecting his social duties, was deemed a fit subject for a Commission, and deprived of his civil rights merely because his mental disorder would fall under the definition of lunacy. On the other hand, one who had no delusion, but great mental weakness, such as to incapacitate him for properly managing his affairs, was not deemed a fit subject for a Commission; since weakness of mind and insanity were considered to be two entirely different states—the latter alone requiring interference, although the injurious results were the same in both cases.

It is unfortunate that these Commissions have been hitherto conducted on so expensive a scale as to render them applicable only to the wealthy classes of society:* and even here the expenses attending such a simple inquiry as that for which the Commission is issued are often of the most ruinous kind, and the results are by no means satisfactory. [See the cases of *Mr. Davies*, *Miss Bagster* (July 1832), *Lady Kirkwall* (Feb. 1836), *Mrs. Cumming* (1846), *Mr. Windham* (1861–2), and others]. When insanity is pleaded in a criminal case, one judge and twelve jurors will decide the question, affecting as it does the *life* of a person, in a few hours, and at very little expense to the country! It is difficult to understand why, in a question of competency to manage affairs, so many more functionaries should be required, so much more time (sometimes amounting to thirty days) occupied, so many witnesses examined, and such enormous expenses incurred. The property of tradesmen, and other persons of small means, is under such a system left unprotected. This expensive process of wasting an alleged lunatic's fortune in order to determine whether he is or is not likely to waste it himself, leads to the result that, compared with the number of lunatics under confinement, the inquisitions are very few. Out of 3,774 persons above the pauper class confined in 1850, there were only 238 cases in which inquisitions were held—*i.e.*, there is only one lunatic in eleven whose property is thus protected by a Commission, apparently because the protection involves a greater waste than if it were left unprotected! ('Med. Gaz.' vol. 46, p. 1023.) From a published report it appears that from the passing of the Lunacy Regulation Act in 1853, down to the end of April 1862, there were 575 enquiries in cases of lunacy, but in only 21 of them was there a trial by jury. Of these last, twelve trials occupied one day each; three took two days each; one, three days; three, five days; one, nine days; and one monster case, thirty-four days.

In introducing a new Lunacy Act in February 1862, the Lord Chancellor stated that in the commission on *Sir Henry Meux* the expenses amounted to 6,941*l.*; in the case of *Mrs. Cumming*, whose insanity was manifested the moment she appeared before the jury, the costs were 5,000*l.* In another case the expenses were 1,909*l.*, of which 250*l.* were the costs of the witnesses alone; and in the case of *Mr. W. F. Windham* the trial lasted thirty-two days, at a cost on each side of about 15,000*l.* Under the amended law no Commission of Lunacy can be had at a less expense than 60*l.*, and this only in uncontested cases.

By a new regulation, the Lord Chancellor has it in his power to direct an enquiry before one or two commissioners, in which case a jury is dispensed with. Evidence may then be received, and the decision left with the commissioner or commissioners so appointed. The costs of an enquiry by this regulation are greatly reduced. This form of proceeding was adopted in reference to the *Earl of Kingston* (April 1861), and the Master—(Warren) speedily brought to a close by his decision a case which under the jury system might have been protracted for two or three weeks. The Lunacy Regulation Acts are the 16th and 17th Vict. c. 70 (1853), and the 25th and 26th Vict. c. 86 (August 1862). The last-mentioned Act has greatly improved proceedings in lunacy, and has removed much of the injustice which formerly prevailed. In order to shorten these enquiries and lessen the expenses, the order under s. 3 is to be confined to the question whether or not the person is 'at the time of unsound mind and incapable of managing himself and his affairs.' No evidence on his conduct is to be received as a proof of insanity unless it refers to a period within two years of the date of the enquiry. In cases of contested imbecility this provision might exclude important evidence, but there is a discretionary power in the judge to admit it. Section 4 allows of the case being tried by a jury at common-law. The alleged lunatic is to be examined before the taking of the evidence, and at the close of the proceedings before the jury consult on their verdict. Under s. 12 power is given to the Chancellor to dispense with commissions in reference to persons who have but small property, and there are in this statute other strict rules regarding the visiting of lunatics confined in asylums.

One source of difficulty on these occasions is, that medical witnesses are allowed to be summoned by both parties, and the opinions given by them often exactly neutralize each other; they are hereby converted into partisans in the cause as much as if they were counsel. It has been well remarked, that a man even unknown to himself, with the purest intentions and the most perfect rectitude, will insensibly lean to the side on which he has been consulted or employed. ('Pagan,' p. 301.) The public are apt to infer, from such conflicting opinions emanating from men of equal experience, that the difference cannot depend essentially on the *medical* facts of a case, and that the question might as well or even better be determined by non-professional persons. See the case of *Carpenter* ('Dublin Med. Press,' July 16, 1845, p. 46); also that of *Mrs. Cumming*, in which the conflict of medical testimony was even greater than usual. A large portion of this lady's property was spent in determining by a verdict that she was insane; and there was an intention that the remainder should be expended in reversing the decision, when the unfortunate lady died. (The reader will find an elaborate report of this remarkable case in the 'Journal of Psychological Medicine' for April 1852.)

One remedy for this serious evil would be, that medical experts on such occasions should be appointed by the Lord Chancellor, to examine an alleged lunatic and give evidence on his condition; they should be in all cases made perfectly independent of both parties. At present they rather occupy the position of medical counsel than medical witnesses, for it is quite clear that no one would be summoned whose views did not coincide with those of the party summoning him; and it is an opinion among some solicitors—for which, unfortunately, there is apparent reason—that medical evidence on these occasions is a marketable commodity, and may be purchased at graduated prices! There are some medical men who appear to think that on these occasions they are justified in sinking the witness in the advocate, and that they are bound by a sort of duty to make the best of the case for the person who retains them: but this is a mistaken view of their position. An advocate is not bound by an oath to state 'the truth, the whole truth, and nothing but the truth;' but a scientific witness is placed under this sacred obligation, and it is a duty which he owes to his profession and to society that he should lay aside all personal bias. It may appear an innocent matter to suppress some facts and to exaggerate the importance of others, in order to induce a jury to pronounce one whose mental soundness is in question to be perfectly sane and competent: but the same mercenary zeal which would thus lead to the civil freedom of an insane person, might on another occasion be employed in unjustly depriving a sane person of his liberty. The confidence of the public in medical opinions in reference to the insane has been by recent events already much shaken; and it would be altogether destroyed, and such opinions entirely dispensed with, if it were once known that a medical man on these occasions accepted a retaining-fee not to speak the whole truth but, rightly or wrongly, to give his evidence in favour of the party who consulted him. Whatever may be the difficulties of the case, experienced solicitors know that if they only search far enough they will generally fall upon some medical men who will adopt their views. (The reader will find some remarks on this subject in the 'Medical Gazette,' vol. 5, p. 719; vol. 11, p. 740; and vol. 17, p. 816.)

A proper course of proceeding was adopted in *Re Taylor* (April 1857).

This gentleman had been examined by seven medical men, three of whom pronounced him to be of unsound mind, and four declared him to be perfectly sane but with an impaired memory. There was here a majority of one in favour of sanity. The Lords Justices then deputed Dr. F. Winslow to examine and report on the condition of the lunatic for their special information. He reported in favour of soundness of mind, admitting the existence of defective memory partly arising from age, but not to so great a degree as to render him incompetent to manage his affairs. The decision of the Court was in accordance with this view.

The law of Scotland has, in reference to these cases, the advantage over that of England in simplicity and justice. A factor is appointed, on the application of relatives, to take charge of the property; notice is given to the alleged lunatic, so that he may, if he pleases, oppose the appointment; medical evidence is received, and upon this, the decision of the Court is chiefly based. The appointment, if made, can at any time be revoked upon good and satisfactory grounds.

Examination of alleged lunatics.—To determine whether a person is or is not a fit subject for interdiction or deprivation of civil rights, it is necessary to bear in mind that it is not enough to show there is *delusion*, as in the lighter cases of monomania; but we are bound to ascertain how far the delusion affects the judgment of the person, so as to prevent him, like other men, from managing his affairs with provident care and propriety. In many instances, however, some proof of *delusion* only is sought for; and if this be procured, it is hastily inferred that the person must be entirely incompetent to manage his property. The most difficult cases are those which involve questions of imbecility. In conducting the defence of the *Windham* case (Dec. 1861), Sir Hugh Cairns was allowed by his medical advisers to make the following strange statement: 'In a case of insanity accompanied by delusions, the mode of investigating it so as to arrive at the truth is a matter of great difficulty and doubt; but in a case of imbecility, where there is either no mind at all or next to none, the task of coming to a right and just decision is comparatively easy.' Such a statement is the reverse of the truth, and must have been made under some hazy notion that the state of imbecility was identical with that of idiocy. One of his own witnesses (Dr. Sutherland), in a subsequent stage of the proceedings, corrected this error, by the admission in cross-examination, that 'drawing the line between soundness and unsoundness of mind in cases of imbecility, is one of the most difficult questions of medical science.'

In conducting the examination of an alleged lunatic, we should compare his mind as it is with what it has been; and if it be a case of supposed imbecility, a proper regard must be had to age, society, education, and general conduct. We should also consider whether the person has been treated by his friends and relations as a lunatic or imbecile prior to the issuing of the commission. A young person whose education has been much neglected, and who has never been entrusted with the care of money, cannot be expected to have much knowledge of the method of managing a large property. Questions are sometimes put on the moral responsibility of man and the attributes of God, to one who, perhaps, never heard of ethics or metaphysics. Again, mathematical and arithmetical questions, which would embarrass many persons who are set down as sane and competent, are sometimes put in cases of alleged imbecility. In one instance a physician gave evidence on a commission that he found the alleged imbecile could not work the first proposition in Euclid, but this person admitted that he had always disliked mathematics. In a case which occurred in Scotland, one examiner asked the alleged imbecile, who said he had 1,200*l.* in the Bank, and received 20*l.* for interest,—How much was that per cent.? He said he could not tell; he was no good hand at arithmetic. The counsel who appeared against the brieve or commission afterwards put the same arithmetical question to one of the medical witnesses who had deposed to the imbecility of the party; and this witness, an educated man, confessed himself quite unable to answer it—a practical illustration of the impropriety of pronouncing a person to be imbecile or incompetent merely because he is ignorant of that which he has never been taught! (Case of *David Yoolow.*) If the capacity to manage affairs rested solely upon a knowledge of arithmetic, many now go free who ought to be immediately placed under interdiction. This is rather a commercial test of insanity: but it will be found that it has been applied in a very improper manner to determine the capacity of young and ill-educated women. Unless the questions are confined to those subjects which the person has had either the opportunity or inclination to learn, a medical witness will always incur the risk of confounding mere ignorance with imbecility.

One of the best tests of mental capacity will be found in determining the degree to which, with ordinary opportunities, a person has shown himself capable of being instructed; but too high a standard must not be assumed as a test of capacity. The mind of an alleged imbecile should not be compared with the most perfect mind, but with that of another person of average capacity, of the same age and station in society, and who has enjoyed like opportunities of instruction. It would be difficult to find two sane persons who were exactly equal in mental power: in some, one faculty is prominently developed, in others another. All that we have to look for in these cases of alleged unsoundness, is an average degree of intellectual development so as to qualify the person for performing the duties of his station. To win the confidence of an alleged lunatic for the purpose of examination, we should not treat his observations or delusions with levity, but rather seriously sympathize with him in his troubles; we should listen attentively to all he has to say, for his suspicions will be excited by many questions being put to him. If we cannot agree with his conclusions, we should not contradict him abruptly, but endeavour to draw him out by asking for some corroborative evidence of his statements. Dr. Millar has properly advised that, before visiting the patient, we should make ourselves thoroughly acquainted with every particular connected with his history and condition, and treat him as much like a sane person as possible. The insane are exceedingly suspicious, and quick to detect any deceit practised on them. They are also jealous of the intrusion of strangers, and, unless great tact is employed, will look upon a medical man as an enemy. ('Hints on Insanity,' p. 58.) The patient should be informed that his perceptions are merely the result of natural disease; it is useless to tell him that he is under a delusion when his perceptions, although sometimes exaggerated, are too real to be doubted. (Op. cit. p. 36.)

The conflicting medical evidence given on Commissions of Lunacy is in great part to be ascribed to the fact, that the whole of the mind of the person is not fairly examined. One physician tests one faculty, another, another; each has his own theory of insanity, and each his standard of competency. The witnesses in support of the commission do not go so much to test the actual state of mind of the person, as to discover what they deem proofs of insanity: those against the commission take an opposite course—they look only for some proofs of soundness. It cannot therefore happen otherwise than that different conclusions should be drawn under such different modes of investigation. There is another point which requires attention in these cases. Persons labouring under slight degrees of imbecility are very soon irritated; they are easily persuaded that they are illused and persecuted; and when they happen to be questioned by parties who are represented as their enemies, they lose their self-command, and are no longer able to answer questions, which under their ordinary state of mind they would reply to with perfect accuracy. (Pagan, Op. cit. p. 302.)

A defective *memory* must not be hastily set down as a proof of legal unsoundness. In a case which came before the Lords Justices Bruce and Turner in August 1855 (*Re Toplis*), the petitioners for a commission appeared to have relied chiefly on a defect of memory in a person who was advanced in life. The Lords Justices, in dismissing the petition with costs, made the following observations:—'Mr. Toplis' powers of recollection were impaired and defective; but this at advanced periods of life, and also at periods not advanced, was a common defect. A man might have a bad memory but be competent and efficient, and no man would venture to suggest that a person could not discharge the business of life because he had a bad memory. The memory, indeed, might be so deficient as to bring a man within the technical description of unsound mind, but it could not be suggested that this was the case with Mr. Toplis. He appeared to recollect the events of his early life with readiness and freshness, and the more recent the event was, the sooner it faded from his memory; but, bad as his memory might be, he had more than sufficient mind, within the ordinary meaning of the terms, to enable him to manage himself and his affairs.' Dr. Southey, who had been instructed by their Lordships to examine Mr. Toplis, made use of the following expressions in his report: 'With a memory so deficient, it can hardly be said Mr. Toplis is of perfectly sound mind.' In one sense this might be true; but, as their Lordships observed, there was a technical meaning of these words, in reference to which they dissented from their use. A man may not have a perfectly sound mind, and yet have a mind sound enough for the management of his affairs. A defective memory in an aged person, taken alone, proves nothing. (See 'Ann. d'Hyg.' 1836, vol. 1, p. 192.)

A medical witness must not allow himself to be embarrassed by medical or legal definitions of insanity. The malady may not assume the form of lunacy or idiocy, in a strictly legal view—nor of mania, monomania, dementia, or idiocy, in a strictly medical view; but still it may be a case of *such mental disorder* as to create *an incapacity for managing affairs.* This is the point to which a medical examiner has to direct his attention. Cases of imbecility present the greatest difficulty, and create the greatest conflict of opinion among medical witnesses. Imbecility strictly implies a weak or feeble mind, and the term is properly applied to one who has an intellect below par or below the normal average. The vagueness of these terms shows how difficult it is to draw a clear distinction between legal sanity and that degree of mental weakness implied by imbecility which would justify interdiction. Insanity in the common acceptation of the term cannot be proved in these cases: there will be no evidence of delusion, and there may be such an amount of self-control as to enable a person to maintain a conversation. Memory, judgment, and other faculties, although weak, are still present in a greater or less degree; and from one or two interviews only, an examiner might be disposed to pronounce the person of sound mind and competent to manage his own affairs. There is a wide field for argument here; for it may be said with some truth, in a defence, 'that the doctors cannot put their fingers on a single point indicative of insanity.' In short, each fact specified by them may be frittered away by the remark that every one must have known some person who had either a bad memory or a weak judgment; who squandered money, who wasted it on unworthy objects, who hoarded it and refused to pay just debts, or who lost it in foolish speculations, &c. All this may be true, and yet the person in question may be legally of unsound mind and properly interdicted. As Dr. Pagan justly remarks, there is a facility of disposition in an imbecile or weak-minded person, which lays him open to be imposed upon by the artful and designing; and our conclusion regarding his competency must be the result of a just appreciation of his general knowledge of affairs, derived from an examination of *all* his faculties. We have to consider how far his imperfect mind would prevent him from attending to his own interests, not in a manner which would ensure their most profitable application, but in such a way as would prevent his affairs from being involved in ruin. His knowledge and understanding may be so imperfect that his property would necessarily run to waste under his unassisted control. When it is proved that there has been habitual submission to the dictation of others, either from a long habit of being controlled, from indifference, or fear—when a man has allowed himself to be disobeyed or neglected by his servants, and to be openly cheated by tradesmen,—these circumstances furnish evidence of weakness of mind, and a justification of the opinion that there should be interdiction. (Op. cit. p. 293.) On the other hand, if a person when left to himself has managed his affairs with reasonable care and propriety, and has acted independently of others, there can be no stronger proof of legal competency.

The testamentary capacity of imbeciles may be tried by the same rules. A man who is of such an easy disposition as to be improperly influenced in the use of his property while living, may be equally influenced by fear or control to make an improper disposition of it by his will; but in this case the terms of the will, if drawn up by himself, will allow a fair judgment to be formed of the mental soundness of the testator. There is on these occasions a method of testing the state of mind which has been suggested by Dr. Conolly—namely, by inducing the patient to express his thoughts in writing, as in a letter addressed either to his physician or to some confidential friend. This plan would probably often succeed in developing the existence of a latent delusion, when an examination would wholly fail; the patient would not be led to suspect that he was being subjected to an examination for a hostile purpose. The current of his thoughts would be uninfluenced by the suspicion, that the act of writing was to test the state of his mind; and as no man can long write in a connected manner who does not think collectedly, so we may expect to find ample evidence whether a delusion exists or not. An instance of the efficacy of this plan is recorded by Dr. Pagan (Op. cit. p. 19). A lady suspected to be of unsound mind wrote a letter to a friend in which was a quotation from Scripture. She gave a correct reference to the part of Scripture where the passage was to be found—thus, 'Philippians 3 ch. v. 7;' and immediately added, 'These islands lie in latitude north ——, and longitude ——,' most probably referring to the geographical position of the Philippine Islands. Here was undoubtedly a defect in the faculties of association and attention. As this defect exists to a greater or less extent in all cases of insanity, this method is well adapted for testing the state of the mind with or without an oral examination. There are cases recorded in which the evidence of delusion has been derived from the terms of a will or deed written or dictated by a lunatic, when there was great difficulty in obtaining proof by an oral examination.

In idiocy there is no capacity for writing. In dementia, as there is no memory, it commonly happens that the same word is written over and over again. No person in a state of dementia can write a connected sentence, because before the last part of the sentence is completed the first is entirely forgotten. In imbecility we may meet with every variety of mental defect, but the state of the mind is pretty well shown by the expression of the thoughts in writing. This method, it must be remembered, cannot show whether or not a person is capable of managing his affairs: it is a mere index of a certain state of the mind, and must be coupled with general habits and conduct before any conclusion is drawn from it relative to the propriety of interdiction. It will often serve to detect the existence of a delusion when other means fail. Some years since I was consulted by a respectable woman who had been housekeeper to the late Dr. Back of Guy's Hospital. Her conversation was on the whole rational, except in relation to the subject of poisoning. The following letters which I received from her will plainly show a disordered state of mind; no examination could more clearly elicit the nature and extent of the delusion under which she laboured than these letters, which are selected out of a number which she wrote to me:—

Hemel Hempstead, harts.
Febury 23th, 1857.

to the Faculty gentleman.

I think I ought to apologize for the hasty way in which I wrote to you still I think it is right that the Parliament of my own nation should know the awful Conspiracy against me now 20 years I have received Poison in milk by two different People since I left the other at your horspital a part of which Poisoned my Poor Cat I have som of it now I did not take any of that myself I should have left hear at the time but my landlord damanded three months notice from Christmas last or the rent and as I Could not Pay two rents I have been obliged to remain hear untill now but if the are allowed to go on with me in this way I shall never have A home if Docter Back is well enough to be Consulted will be so kind to do so for me as I think it is right he should know of this letter and all other that I may bring you if you Please if you should think proper to Call on those gentleman Messrs R—— & F—— Professor taylor knows them for he told me so and spoke very kindley of them and every letter that I wright to tham and the government which I have been Compeld to do every word is the facts at the time I write them the same as this unalterable for ever

I am gentleman your
Most humble servent
M—— W——.

Bushay heath Novemer the 3—1857.

Dr A Taylor Snt Thomas Horspitle Beromdsay.

Sir

will you please to pardon the liberty I have taken) by asking you to be so kind to keep this letter as a witness for me in Case of death as I think will be the Case from the Poison given me in so many things I have now brought A little brandy and some more beer which as made me very ill) and I most humbley aske your pardon if I have don rong by Applying to you as A Physician of medicine at the horspitle but I thought any one may do so if the Could Pay and I was Prepard to do so or I would not have taken such A liberty for the world) I have A government life annuity fifty Pounds a year and if I should be found Poisoned will you be so kind to take this letter to the Parliament of my own nation to whome I have applied for I now am afraid to purchase ayneting any ware,

I am Sir your most humble servent
M—— W——.

Dr. Forbes Winslow attaches some importance to handwriting as foreshadowing the occurrence of general paralysis with softening of the brain. This, however, refers not so much to composition or style as correct writing and spelling. (Op. cit. p. 464.) The reader will find a complete essay on the writings of the insane, and the medico-legal conclusions to which they lead, by Dr. Marcé, in the 'Ann. D'Hyg. Publique,' 1864, vol. 1, p. 379. When a verdict of insanity is returned under a commission, it must always represent the party to be of unsound mind, and by reason of that unsoundness to be incompetent to manage his affairs. A date must be fixed at which the insanity first appeared, and this date should always be anterior to the issuing of the commission. If there be lucid intervals, the space of time occupied by these should also be defined.

Among many cases which illustrate the medical evidence required and received on Commissions of Lunacy, I would refer to that of *Miss Bagster*, in July 1832; it will serve to show upon what slight grounds a verdict of 'unsound mind' was at that date returned under a Commission of Lunacy. The subject of this inquiry was shown by the evidence to be a frivolous and weak-minded girl, whose education had been much neglected. She was heiress to a large fortune, and contracted a clandestine marriage unsuited to her condition. A commission was taken out by her friends for the purpose of annulling her marriage, by showing that she was not at the time competent by defect of understanding to give rational consent. The general evidence established that there had been great neglect in her education, and that she had been especially indulged; but it did not appear that she had ever been treated by her friends as of unsound mind, nor indeed that any question of her insanity had been raised until *after* the marriage. Seven medical witnesses, summoned to support the commission, deposed that she was of unsound mind. On the other side no witnesses were called, as it was considered that the allegation of insanity was not made out. The Commissioners, however, themselves called Dr. Morrison and Dr. Haslam, who deposed that her incompetency to manage her affairs arose not from unsoundness of mind, but from ignorance. She gave one strong proof of her sanity, namely, that she was aware of her deficiencies. It seems to have been allowed that she was capable of controlling herself, and also of concealing her defects; her answers to the questions put to her were pertinent, and were for the most part correctly made, and she had manifested a capacity to receive instruction. She was ignorant of arithmetic, but this she had never been properly taught. She was young and inexperienced, and therefore unable to answer questions relative to the management and expenditure of a household. The jury, by a majority of twenty to two, returned a verdict that she was of unsound mind, and had been so for the space of two years—a time which covered the marriage. (For an excellent medico-legal report of this case, see 'Med. Gaz.' vol. 10, pp. 519 *et seq.*),

It is worthy of remark that the only two medical witnesses independent of both sides, who were summoned by the Commissioners, gave a very strong opinion that Miss Bagster was *ignorant* and not of unsound mind; and that she might, by instruction, be rendered competent to the management of her affairs. We should imagine that when a question arose, whether a young person was or was not to be deprived of all civil rights, there ought to be at least unanimity among the medical opinions; or, if this were denied, then more weight should be given to the negative than to the affirmative side of the question, provided if, as in this case, the negative view were supported by men impartially selected, and of great experience and knowledge on the subject of insanity. It is not improbable that besides ignorance, there may have been some degree of weakness of mind about this person; yet, taking the whole case, we must attribute the verdict of unsoundness not so much to mental infirmity as to incapacity for want of instruction to manage a large fortune. But if every wealthy young lady, whose education had been equally neglected, had her sanity tested on the same points as Miss Bagster, it is certain that many who are now free agents would be placed under interdiction! It was attempted to justify the verdict by the statement that it saved this lady from the results of an imprudent marriage—the answer to which is, that Commissions of *Lunacy* are not intended to shield persons whose minds are not really unsound from the results of foolish and imprudent acts!

In the case of *Mr. W. F. Windham* (December 1861) the question raised on the commission was similar to that in the case of Miss Bagster. Fifteen of the relatives of this gentleman petitioned for an inquiry into his state of mind on the ground that he laboured under congenital deficiency of intellect; and on the other side it was argued in favour of Mr. Windham, that his mental condition, if below the normal standard, was entirely owing to the results of a neglected education. The inquiry lasted thirty-three days, during which 140 witnesses were examined—namely, fifty on the part of the petitioners, and ninety in favour of Mr. Windham. There was the usual amount of conflicting evidence, medical and general. There was no proof of the want of the opportunity of education, but strong reason to believe that the alleged imbecile had not made use, like other boys of his age, of the advantages which he had enjoyed. He had been sent to Eton, but had derived little benefit from his connection with that great public school. It seems to have been admitted that as a boy he was wholly unlike other boys, and when he attained his majority, in August 1861, his conduct was extravagant, wild, and wholly inconsistent with his social position. At the same time he was not entirely deficient in business matters; for it was proved that his uncle, one of the petitioners, had shortly before negotiated with him for the sale of a piece of land of the value of £1,000, thereby admitting his capacity to transact business. The evidence received on this occasion was allowed to extend to the whole of his life, and it may be observed that in cases of alleged imbecility it is not possible, without doing injustice, to prevent the reception of evidence from a long date. Imbecility is a congenital deficiency of mental power, and it is therefore always material to show whether this has or has not existed from youth upwards.

A large mass of testimony, much of which was irrelevant, was thereby introduced into the case. The facts mainly relied on in support of Mr. W. F. Windham's incompetency were:—that he was very extravagant in purchasing articles which he did not require at exorbitant prices and in unnecessary quantities; he thus incurred debts of enormous amount without any reasonable prospect of being able to pay them off—that he was guilty of gross indecency of language and conduct in public places, and even in the presence of ladies he appeared to have no sense of shame—that he habitually associated with low characters and prostitutes, and three weeks after he had attained his majority he married a woman of disreputable character, who up to the night before her marriage had been the paramour of one of his associates—that having infected this woman with the venereal disease he gave her presents in jewelry amounting to from 12,000*l.* to 14,000*l.*, and settled upon her 800*l.* per annum for life, as a compensation for his misconduct,—his income at this time not being more than 1,250*l.* per annum. Although this woman after her marriage had cohabited with another man, yet he (Windham) had again lived with her, and had manifested no sense of shame in reference to this act of condonation of adultery. He was in the habit of dressing himself and acting, sometimes as a detective officer, then as a railway-guard, and on one occasion he locked in a railway-carriage the woman whom he had married and the man with whom she had previously cohabited. The petitioners looked upon these acts as indications of unsoundness of mind and incompetency to manage his affairs with reasonable care and propriety; the ninety witnesses in favour of Mr. Windham regarded them simply as playful eccentricities and boyish tricks! The medical evidence for the petitioners chiefly rested upon Dr. Forbes Winslow and Dr. Mayo: they were appointed as examiners by the Lords Justices, and Dr. Bright was associated with them as assessor. Nothing could be more fair than the mode of testing the mental condition of the alleged imbecile. There were two interviews, lasting altogether three hours. Numerous questions were put on a variety of subjects, but it was found very difficult to induce Mr. Windham to concentrate his thoughts on any one point. Dr. Winslow considered him to be in a state of mental imbecility, and that he was a person of unsound mind incapable of managing himself or his affairs. The degree of mental unsoundness under which he laboured was not inconsistent with a capacity to write letters—to acquire a certain amount of classical knowledge or the ordinary rules of arithmetic—to settle small accounts and make purchases to a limited extent. In cross-examination by Sir H. Cairns the usual stock-objection was taken to this opinion—namely, that the witness could not say where sanity ends and insanity begins. Dr. Winslow correctly admitted that it was impossible to trace the line of demarcation. At the same time mental unsoundness might be appreciated; it implied such a degree of mental deficiency as would incapacitate a person for the management of himself and his affairs. Inability to command the attention and incapacity of sustained thought were symptoms of the peculiar kind of imbecility under which Mr. Windham laboured. Deadness to a sense of moral obligations is also frequently observed in such cases. Dr. Mayo in his evidence concurred with Dr. Winslow; he considered that Mr. Windham had a weak and childish intellect and an impure mind; he manifested utter shamelessness respecting the circumstances of his marriage and his conduct before and afterwards. Dr. Southey, also appointed by the Lords Justices to examine Mr. Windham, came to the conclusion that he was labouring under imbecility and was of unsound mind. His conversation was more rational than his conduct, and from conversation alone he could not have come to the conclusion that he was of unsound mind. Further, judging from his private interviews with him, he considered him to be a person of weak intellect, but he 'should hesitate to express the opinion that he was not capable of managing himself or his affairs.'

On the other side, Dr. Tuke had examined Mr. Windham, and came to the conclusion—1st, from his powers of observation; 2ndly, from the manner in which he instructed his solicitors for his defence; and 3rdly, from his delicacy in conversation when there was an opportunity of introducing indelicate remarks—that he was not imbecile. He also thought that his sanity was perfectly consistent with his getting into debt to the amount of 25,000*l.* or 30,000*l.* and giving 14,000*l.* worth of jewelry to his wife. Dr. Seymour, a Commissioner of Lunacy for eight years, examined Mr. Windham, and was with him a sufficient time to enable him to form an opinion of the state of his mind, and he saw nothing to justify him in saying that he was of unsound mind. He was certainly not a lunatic, and he was under no delusion. He was capable of managing himself and his affairs, but the inquiry would have a considerable effect in improving him. Mr. Hancock stated that during his interview with Mr. Windham he neither saw nor heard anything which would justify him in arriving at any other conclusion than that he was of sound mind. Dr. Hood, of Bethlehem Hospital, had had several interviews with him, and considered him to be of sound mind and competent to manage his own affairs. Dr. Sutherland, as the result of an examination and from the evidence heard in Court, considered Mr. Windham to be of sound mind; there were no symptoms of congenital imbecility or of idiocy about him. In cases of imbecility he always went by practical tests, and in his opinion an imbecile should be incoherent in language and inattentive to the calls of nature. 'There was no incoherency in Mr. Windham's conversation.' He was rather below the average in point of intellect, but he did not at all approach the line where imbecility began. No amount of eccentricity should be received as evidence of insanity unless it is accompanied by some unmistakable proof of unsoundness. Dr. Conolly examined him on two occasions, and believed him to be of sound mind; there was not one single indication of unsoundness about him. No medical man could sign a certificate of insanity in his case, and no keeper of an asylum would think of taking him as an inmate.

The Master in Lunacy, Mr. Warren, in addressing the jury said:—'The question to be decided was not whether Mr. Windham was absolutely insane, but whether there was such imbecility of mind, not amounting to actual insanity, as to render him unable to act with any proper or provident discretion, or to render him liable to be robbed by anyone. The broad question was whether he was of sufficiently sound mind to be entrusted with the management of himself and his affairs. Mere weakness of character, mere liability to impulse good or bad, mere imprudence, recklessness, and eccentricity, to which might be added immorality, did not constitute unsoundness of mind unless, in looking fairly at the whole of the evidence, there was good reason to refer them to a morbid condition of the intellect. They might furnish evidence of unsoundness but they did not constitute it.'

Mr. Windham then underwent a private examination before the jury, and it is said that he gave proper answers to the various questions put to him. The jury, by a majority of 15 to 8, returned the following verdict—'That Mr. Windham is of sound mind and capable of taking care of himself and his affairs.' After the verdict had been returned pronouncing him sane and competent, he was guilty of other eccentric acts, exhausted a splendid fortune and became a bankrupt; showing that, whatever legal soundness of mind he might possess in the opinion of two-thirds of the jury, he practically did not evince that capacity which they declared him to possess of taking care of himself or his affairs!

A large section of the public joined in the view prominently put forward at the inquiry by his counsel, Sir Hugh Cairns, that this unfortunate young man had been made the victim of a charge the most cruel, unjust, and unjustifiable! Insanity, it was urged, in the ordinary acceptation of the word did not exist in his case. There were no illusions, hallucinations, or delusions; but as these are never met with in the form of unsoundness imputed to Mr. Windham, namely imbecility, their absence proved nothing for or against the existence of imbecility or weakness of mind. But what test is there for imbecility except conduct and conversation? There was no incoherency of language, but there was strong evidence of habits such as we do not meet with among men of really reasonable minds: but opinions were divided on the question, whether these indicated unsoundness of mind, or a mixture of eccentricity and moral depravity from deficient education. A majority of the jury took the latter view; and Lord Chelmsford, in commenting upon this verdict in the House of Lords (March 1862) said:—'The law as laid down by Lord Lyndhurst applied to cases short of insanity, but they must be cases of unsoundness of mind; and mere extravagance or follies, which indicated imbecility, would not be sufficient unless the imbecility amounted to unsoundness of mind.' The legal test of the existence of this state of mind, we are told by high authority, is 'conduct.' A lawyer means by madness 'conduct of a certain character,' while a physician means by it 'a certain disease one of the effects of which is to produce such conduct.' ('Crim. Law of England,' by Fitzjames Stephen, p. 87.) The whole evidence against Mr. Windham bore upon conduct, and from the verdict we learn what sort of conduct does *not* constitute madness in a legal sense. The marrying of a woman of a disreputable character,—the squandering upon her of 14,000*l.* in jewelry, and settling upon her 800*l.* per annum, with other extravagant acts of a similar kind, do not constitute 'conduct of a certain character' sufficient to render a man *non compos mentis* in the eye of the law; but if these acts evince soundness of mind and a competency to manage affairs, what are the acts which indicate unsoundness or incompetency? On the other hand, we are told that the physician looks to the existence of a certain disease; but a physician can know nothing about the existence of disease of the brain during life in any case of imbecility, except in so far as its effects may be manifested by conduct. We therefore come round to the legal test of 'conduct,' which in Mr. Windham's case was considered to be quite consistent with the provident management of a large estate and a splendid fortune. That the legal test was here a failure in affording protection from wastefulness is proved by the result—the loss of the whole property from reckless extravagance!

This case, as usual, drew down upon the medical profession some severe comments; and among others the Earl of Shaftesbury, who had had considerable experience in the working of the law of Lunacy, made the following observations:—'He did not know that medical gentlemen (he said it with all respect), unless they had made insanity their special study, were more qualified to judge of the soundness or unsoundness of mind than any person of common-sense and practical knowledge of the world. Mere opinions and scientific speculations ought no longer to be adduced in the Courts as testimony. Whatever evidence was given by a medical man should be facts, and judgment based on these facts. From his own experience of many years on the Commission of Lunacy, he could affirm that medical men who had not made the subject a special study were as ignorant of mental disease as anyone who observed it for the first time. It was to facts, and facts alone, they must look. He thought it a monstrous thing that a medical man should infer, because a person had a cast in his eye, or a particular shaped head, that he must be insane, when in fact he commits no mad act at all. Facts observed by himself ought to be the basis of the evidence of a medical man. He maintained that persons of common-sense, conversant with the world and having a practical knowledge of mankind, if brought into the presence of a lunatic, would in a short time find out whether he was or was not capable of managing his own affairs. He perfectly well recollected an instance that showed how little many eminent medical men were acquainted with what was going on in the world, and how they formed an opinion and came to a conclusion without any foundation in fact. When discussing the question of the insanity of a lady, he (the Earl of Shaftesbury) strongly maintained that she was perfectly sane and capable of managing herself and her affairs; a medical man of great eminence took him aside, and told him the lady must be insane, "because she subscribed towards the conversion of the Jews!" Had that medical gentleman been acquainted with what was going on in the world, he would have known that hundreds and thousands of persons of the most sane and solid description were doing the same thing. In the case of another lady, it was argued that she must be insane because she was in the habit of wearing a dagger at her side, and the dagger was produced. He told the lady that one of the charges against her was that she wore a dagger. "Dear me!" she said, "if I am insane nine-tenths of the ladies in Paris are insane too, for they do the same!" He took the dagger to a shop, and inquired into the matter. He was told that they had sold 70 of the same sort within a few days; that wearing them had become a fashion in Paris, and was becoming the fashion in England. Yet a person calling himself a "mad doctor" said the lady must be insane, because she wore a dagger! That a medical man should be allowed to be in Court, hear all the evidence, and on that come to a conclusion himself, he thought was a vicious practice. A great deal that was said was not evidence at all, but it was likely to produce a very serious effect on the Master, the Jury, or the Judge. It was a wrong method. Could anything be more remarkable than the discord that existed among all these doctors on the subject of insanity? They did not agree among themselves,—they were perpetually at variance with each other, and they would find the strongest, most discordant, and dangerous opinions given by medical men.'

This is a most illiberal view of medical testimony, and an unjust depreciation of its value in cases of alleged lunacy. Medical opinions, like legal opinions, are sometimes hastily formed from imperfect data, but this is no imputation on the general good faith of the members of the two professions. As long as men's minds are not constituted alike, they are not likely to agree in their conclusions, even with the same elements before them. The learned judges of our different Courts frequently differ *toto cœlo* in their judgments, and thus cause much anxious and protracted litigation in reference to patents, nuisances, legitimacy, and other contested questions. Six will take one view and five another, and the question is then decided by the rough test of a majority of *one.* The Earl of Shaftesbury condemns 'doctors' for not agreeing among themselves on the subject of insanity, and suggests that persons of common sense and a practical knowledge of the world are more qualified to judge of soundness and unsoundness than medical men. He forgets however that in the *Windham* case, which elicited his censures, the jury, consisting of twenty-three men with a 'practical knowledge of the world' differed from each other even more than the doctors,—the numbers being fifteen in favour of a verdict of soundness and eight in favour of unsoundness of mind. The minority felt so strongly on the error of the verdict of the majority, that they specially signified their dissent from it to the Lords Justices who had directed the inquiry. This great legal question was therefore simply decided arithmetically by relative numbers, 15 to 8, as in the election of a Member of Parliament!

The chief objections to the evidence of medical experts on those occasions would be removed if they were all nominated by the Lord Chancellor or the Lords Justices, and if they were not permitted to be retained by solicitors on opposite sides of the Commission. So strong was the feeling in reference to medical evidence after this inquiry, that the Lord Chancellor actually proposed to exclude it altogether, except in so far as it was based on *facts* within the personal knowledge of the witness. It was suggested that the general scientific conclusions of experts should *not* be received as evidence. This proposition, which would have been most injurious to the interests of the insane as well as the sane, did not meet with a favourable reception.

Commissions may be superseded, but the evidence must then be as strongly in favour of sanity as it was before in favour of insanity. In *Dyce Sombre's* case (July 1844) the physicians of England and France came to directly opposite conclusions, and English physicians were equally arrayed against each other! (See the judgment of the Lord Chancellor, as reported in the 'Law Times,' Sept. 28, 1844; also a notice of a treatise on his own case and the law of lunacy, by Mr. Dyce Sombre, in the 'Journ. of Psychol. Med.' 1850, p. 409.) There have been few cases in which so great a difference of opinion has existed among medical witnesses as in this. Five English medical practitioners of good standing were, however, in favour of the sanity of this gentleman. The decision was against superseding the Commission, chiefly on the ground of the continued existence of delusion; but the most extraordinary part of the case was that the alleged lunatic was allowed to have the uncontrolled use of a large portion of his property! ('Med. Gaz.' vol. 40, p. 893.) In 1851 arrangements were made for an independent Medical Commission to inquire into the mental state of this gentleman, and, if possible, to reconcile the conflicting medical opinions already given; but before this was constituted, the alleged lunatic died. (For some remarks on this case, see a letter by Dr. Mayo, 'Med. Gaz.' vol. 46, p. 123; also 'Medical Testimony,' p. 31.)

It has been suggested by Dr. Chevers that many of the acts which were considered to indicate insanity in this case might be traced to Oriental habits and prejudices. ('Med. Jur. for India,' p. 574.)

The great caution shown in superseding commissions will be evident from the following case. In *Re Blackmore* (December 1862) a petition for a *supersedeas* of a Commission of Lunacy was presented to the Lords Justices, and was supported by the evidence of Dr. Sutherland and Dr. Forbes Winslow. Lord Justice Turner observed:—'There is no more painful duty in reference to lunatics than to decide whether persons against whom a commission has been issued are so far recovered as to justify the superseding of the commission. It may be that the recovery is apparently perfect so long as the restraint is continued, but the moment the restraint is removed the disease reappears. It must be a subject of anxious consideration whether the recovery will continue when the restraint is removed. Notwithstanding the implicit confidence which the Court places in the medical reports produced and the favourable impression conveyed by the personal interviews which the Commissioner has had with the petitioner, the Court feels that they ought not to go so far as to supersede the Commission, but that it is their duty to see what will be the effect of removing the restraint, and whether the removal of it will be attended with a recurrence of the disease. This course is one which is borne out by both reason and authority. The authorities in favour of it are the judgments of Lord King in *Lord Ferrers*' case, in 1730; Lord Hardwicke, in *Sir William Brooke*'s case, in 1737; Lord Loughborough, in *Errington*'s case, in 1798; Lord Eldon, in *Stock*'s case, in 1813; and Lords Lyndhurst and Cottenham, in *Dyce Sombre*'s case, in 1844 and 1847. After much reflection on the subject I have come to the conclusion, in accordance with these authorities, that the Court ought not to supersede the Commission, but to make an order to suspend all proceedings under it until further order, and that Mr. Blackmore be at liberty to apply for further relief upon his petition to the Lord Chancellor or the Lords Justices in Trinity Term next, and that in the meantime he should have the management of his business and estate without the control or interference of the Committee of his person, with liberty to apply in the meantime.'

CHAPTER 84.

RESPONSIBILITY IN CIVIL CASES—INSANITY AS AN IMPEDIMENT TO MARRIAGE—DEEDS AND CONTRACTS—WILLS MADE BY THE INSANE—TESTAMENTARY CAPACITY—TEST OF CAPACITY—DELUSION IN THE DEED—ECCENTRICITY IN WILLS—WILLS IN SENILE DEMENTIA—WILLS IN EXTREMIS.—RESTRICTION OF MEDICAL OPINIONS.

Insanity as an impediment to marriage.—Insanity is deemed in law to be a civil impediment to marriage, because it is considered that there cannot be that rational consent which is necessary to the validity of a contract. The marriage of a lunatic is therefore called a nullity, and is void *ab initio*. All that the law requires is that there should be good proof of insanity at or about the time of the contract. If this be offered, and it be alleged that the contract was entered into during a lucid interval, then the person who would benefit by the allegation must prove its existence. The suitableness of the marriage, as well as the conduct of the party during or after its performance, will also be considered by the Court. In *Turner* v. *Myers*, a lunatic who had recovered from his lunacy instituted a suit to set aside a marriage which he had voluntarily contracted while in this state! The marriage was declared void. ('Med. Gaz.' vol. 8, p. 481.) The case of *Baldry* v. *Ellis* (Norwich Summer Ass. 1851) will be found of interest in relation to the matrimonial engagements of alleged lunatics.

In *Read* v. *Legard* (Court of Exchequer, May 30, 1851), a question arose whether a lunatic was responsible for necessaries supplied to his wife. The articles supplied were for the sole use of the wife, the husband being a confirmed lunatic and the inmate of an asylum. The Court held that the fact of a husband being from the visitation of God unable to manage his affairs did not absolve him from the obligation, which he contracted when he married, to provide necessaries for the support of his wife. He was then of sane mind, and although he had subsequently become insane, that obligation was not revocable under the circumstances. (See also a report of the case of *Seaton* v. *Adcock*, 'Journ. Psychol. Med.' 1851, p. 297.)

The validity of civil contracts entered into by lunatics will depend mainly on the circumstances which accompany the act. If there be nothing unreasonable in the conduct of the lunatic, and the party with whom he contracts has no knowledge or suspicion of his insanity, then the contract will be binding on the lunatic and his representatives. It was so held in *Monckton* v. *Cameroux* (Exchequer, June 1848). This was an action by the administrator of a deceased person to recover from the defendant, as secretary of an Insurance Office, the sum paid by him as the consideration for two annuities, the foundation of the action being, that at the time of the arrangement in question the deceased was not in a sound state of mind. At the trial before the Chief Baron, it appeared that the negotiation had been conducted by the deceased with apparent prudence, sanity, and judgment, and that the arrangement entered into by him with the Office was just such as any prudent person would have been expected to make with a view to his own interest. The deceased, who died very soon after the business had been arranged, was, both before and after, in an unsound state of mind. Under these circumstances, this action was brought by his representatives, and a verdict recovered by them, subject to the opinion of the Court on their right to recover as on the entire failure of consideration. The Chief Baron, in giving judgment in favour of the defendant, said it was sufficient for the purpose of this case to lay it down as a general rule, that when a person of apparently sound intellect enters into a contract, such as any ordinary person would enter into with others who act *bonâ fide*, and the parties cannot be restored to their former condition, it is no ground for setting aside the contract that one of them was at the time *non compos mentis*. On appeal to the Exchequer Chamber in May 1849, this judgment was affirmed. (See also the case of *Staniland* v. *Willett*, Vice-Chancellor's Court, Nov. 1848.) In the case of *Donat* v. *Haniquet* (Guildhall Sittings, 1854), on an action to recover a sum of money, in which the defence was that the defendant was of unsound mind at the time of the contract, Crompton, J., held that unless it was shown that the plaintiff had taken advantage of defendant's unsoundness of mind, he would be entitled to recover the amount claimed.

Wills made by the insane. Testamentary capacity.—Questions involving the testamentary capacity of persons are of very frequent occurrence, and medical evidence is commonly required for their solution. When property is bequeathed by the testator out of the usual order of succession, it may be alleged by the relatives that he was wholly incompetent to understand the nature of the deed—either from actual insanity, the imbecility of age, or that natural failing of the mind which is so often observed to occur from disease or on the approach of death. Bodily disease or incapacity does not affect the validity of a will, unless the mind be directly or indirectly disturbed by it. Some time since a case occurred in France, in which a will was contested on the ground that the testator when he executed it, was labouring under hemiplegia. The opinion of Esquirol was required, and he said that hemiplegia might undoubtedly affect the brain—a fact clearly indicated by the sight, hearing, and other senses becoming weakened; yet this, in his opinion, did not necessarily indicate an impairment of the intellectual powers. ('Ann. d'Hyg.' 1832, vol. 1, p. 203.) A man's mind, under these circumstances, may not be so strong as in robust health, but still it may retain a disposing power. In *Harwood* v. *Baker*, decided by the Privy Council in 1841, a will was pronounced to be invalid owing to the general state of bodily disease in which the testator was at the time of making it. It appears that he was labouring under erysipelas and fever, and these diseases had produced a degree of drowsiness and stupor which rendered him incompetent to the act. In the case of *Day* (June 1838), epilepsy was alleged to have affected the mind; and in the case of *Blewitt* (March 1833), paralysis was adduced as a ground of incompetency. In all cases of this kind, the law looks exclusively to the actual *effect* of the bodily disease upon the *mind*; and this is commonly a question to be determined by the jury from the testimony of those who have attended the deceased, as well as from the evidence of medical experts.

In the case of *Penfold* v. *Crawford* (C. P. Dec. 1843), it was shown that the testator had lost his speech from an attack of apoplexy; but it was proved by medical evidence that his mental powers, notwithstanding this attack, were good, and therefore a deed made subsequently was held to be valid. In the case of *Whyddon* v. *Billinghurst* (Prerog. Court, July 1850), a will was set aside because it was executed by the testatrix while labouring under an attack of cholera, in Sept. 1849, and proper means had not been taken to test the capacity of the deceased, who at the time of its execution was reduced to such an extreme state of weakness that her mental powers were affected. In all cases of this nature *integritas mentis non corporis sanitas exigenda est.*

The case of the *Duchess of Manchester* (*The Duke of Manchester* v. *Bennett*, Kingston Lent Assizes, 1854) is of importance in relation to testamentary capacity. The Duchess had made a will, which was disputed on the ground that, from bodily illness and mental infirmity, she was not at the time competent to dispose of her property. In 1843 she had made a will bequeathing her property to her children; in 1848 she made another will revoking that of 1843, and bequeathing the absolute control of her property to her husband the Duke. This second will, which was executed on or about the 26th October 1848, was the subject of dispute. It appeared from the evidence that the Duchess had been seized with hysteria and strong convulsions on the 12th of September preceding, but her mind was not then affected. On the 1st of October she was again attacked with convulsions, and, according to some of the witnesses, she laboured under acute mania with symptoms of inflammation of the brain. She died on the 21st November, about three weeks after the execution of the will; and there was evidence to show that she had had some delusions both before and after its execution. A physician who was the medical attendant of the family, and who was one of the witnesses to the will, deposed that on the day it was signed, and for some days previously, the Duchess had recovered her reason, and that at the time of signing it she was, in his judgment, aware of what she was doing, and that she voluntarily delivered it as her own act and deed. It appeared also that the disputed will was substantially such as the Duchess had announced her intention to make long before the execution of it, and when it was not suggested that she was in an unsound or incompetent state of mind. Three medical men of eminence were called on the part of the defendants; and they expressed their opinions, from the evidence, that the deceased at the time of making the will was incompetent to make it: that, in fact, she was proved to have been insane, and there was no medical evidence that she had had a lucid interval. These opinions were based on the nature of the illness, its duration, and the probability (for there was a want of any direct evidence on this point, except that which showed the Duchess to be in a sane and disposing state of mind) that this illness still affected her mind when she executed the will. The point at issue then was—Was she, or was she not, in a competent state of mind at the time of executing the will? The jury found that she was competent, and that the will was valid, but a new trial was subsequently granted by the Vice-Chancellor: this did not take place, as the case was ultimately arranged without it.

It is to be regretted that the rule given at p. 1092 for testing the capacity of the testatrix was not adopted by the medical attendant before he attested the will of the Duchess. Had he applied this rule, there can be no doubt that the whole of the painful litigation which followed would have been avoided. Nevertheless, the evidence for the plaintiff, assuming the statements of the medical gentlemen who saw and attended the Duchess to have been true, appears to show that when the will was executed she had a disposing capacity.

The great point at issue in the case was purely of a medical nature: namely, whether the delusions or wanderings under which the Duchess laboured during her illness were the rooted delusions of *insanity*—fixed mental derangement (mania), or only the temporary delusions of *delirium*, the result of the disease under which she was labouring. In granting a new trial, the Vice-Chancellor very properly stated that, in reference to permanent proper insanity, there was great difficulty in proving a lucid interval. A patient so affected is not unfrequently rational to all outward appearance, without any real abatement of the malady; so that, in truth and substance, he is just as insane in his apparently rational as in his visible raving fits. But the apparently rational intervals of persons merely delirious are for the most part really such. Delirium is a fluctuating state of mind created by temporary excitement, in the absence of which, to be ascertained by appearance and conduct, the patient is most commonly really sane. Further, in cases of permanent or fixed *insanity*, the burden of proof lies on the person setting up the instrument; the presence or absence of delusions ought to be tested at the time; and it should be shown by indisputable evidence that on the subject in question delusion is absent from the mind. If the delusions arose from *delirium*, the onus of proof would not be on the party setting up the instrument but on those who oppose it.

There probably never was a case in which the necessity of drawing a clear distinction between *mania* in its acute form and *delirium* dependent on disease, was more strongly manifested than in this. The medical facts for the basis of an opinion were really few and simple, and they appear to me to lead to only one conclusion,—*i. e.*, that the occasional wanderings or delusions of the Duchess were the results of delirium from bodily disease, and not of permanent insanity,—that this state is quite compatible with the existence of intervals of perfect competency,—and that the conduct of the Duchess, at the time of executing her will, was such as to show that she had a full knowledge of the nature of the act which she was performing. I draw this conclusion from a full examination of authentic notes of evidence taken at the trial.

Test of capacity.—A person is considered to be of a sane and disposing mind who knows the nature of the act which he is performing, and is fully aware of its consequences. From some decisions that have been made, it would appear that a state of mind for which a party might be placed under interdiction or deprived of the management of his affairs would not render him incompetent to the making of a will. The validity of the will of a lunatic was once allowed, although made while he was actually confined in an asylum; because the act was rational, and it was such as the lunatic, announced his intention of making, some years prior to the attack of insanity. (*Coghlan's* case; see also *Re Garden*, 'Law Times,' July 6, 1844, p. 258; also the case of *Cartwright*, Mayo on 'Medical Testimony,' p. 44.) In *Nichols* and *Freeman* v. *Binns* (Probate Court, Aug. 1858), the question was whether the will of a Mr. Parkinson, made in a lunatic asylum near Norwich, was executed during a lucid interval. The jury found a verdict in favour of the will. The insanity of a person when not already found insane under a Commission, must not in these cases rest upon presumption, but be established by positive proof. The act of suicide is often hastily assumed to be evidence of insanity; but it would not be allowed as a proof of this state, even when a testator destroyed himself shortly after the execution of his will. A case has been decided where the testator committed suicide three days after having given instructions for his will; but the act was not admitted as a proof or even as a presumption of insanity at the time, and the will was pronounced to be valid. A case has been decided on similar grounds in the French Courts. In *Edwards* v. *Edwards* (Prerog. Court, Feb. 1854) it was proved that the testator had committed suicide three days after the execution of his will, and there was some evidence of eccentric habits almost amounting to insanity; but the will was pronounced to be valid. Suicide is not deemed in law to be a proof of the existence of insanity. (See p. 1038.)

Delusion in the deed.—The validity of deeds executed by persons affected with monomania is often a subject of dispute. The practice of the law indicates that the mere existence of a delusion in the mind of a person does not necessarily vitiate a deed, unless the delusion form the groundwork of it, or unless the most decisive evidence be given that, at the time of executing the deed, the testator's mind was influenced by it. Strong evidence is often derivable from the act itself, especially when a testator has drawn it up of his own accord. In the case of *Barton* (July 1840) the Ecclesiastical Court was chiefly guided in its decision by the nature of the instrument. The testator, it appeared, laboured under the extraordinary delusion that he could dispose of his own property to himself, and make himself his own legatee and executor! This he had accordingly done. The instrument was pronounced to be invalid. But a will may be manifestly unjust to the surviving relatives of a testator, and it may display some of the extraordinary opinions of the individual; yet it will not necessarily be void, unless the testamentary dispositions clearly indicate that they have been formed under the influence of *a delusion.* Some injustice may possibly be done by the rigorous adoption of this principle, since delusion may certainly enter into a man's act, whether civil or criminal, and it may not be always in our power to discover it; but, after all, it is perhaps the most equitable mode of construing the last wishes of the dead. According to Sir John Nichol, it is not necessary in civil suits to connect the morbid imagination with the act itself; if the mind is proved to be unsound the act is void. In *Roberts* v. *Kerslake* (Warwick Aut. Assizes, 1854), Lord Wensleydale held that to vitiate a will, if it be a case of delirium, the act must be traced to delirious delusion, but if it be a case of lunacy it need not be traced to the delusion. In *Sharpe* v. *Macauley* (Winchester Aut. Ass. 1856), Martin, B., advised the jury, in coming to a conclusion on the question at issue, whether the testator had a 'sound and disposing mind,' to look not to the opinions of others, but to the man's own acts as well as his correspondence. A disposing mind implied that a man understood the nature of his property, the use and benefits arising from it, and had sense and discretion to select persons to enjoy it after his death. A man may have laboured under delusions and have been confined as a lunatic, yet at the date of his will he may have been sane and have had a disposing power. The main question therefore is—Was the testator of sane mind when the will was executed? This may be deduced from direct evidence of his condition as well as from the provisions of the will itself. Sir C. Cresswell held (in *Davey* v. *Comber*, December 1862), that when it was shown that a man had been mad at some period of his life, it was incumbent upon those who set up his will to prove that his madness had passed away before it was executed. In reference to the will of *Dyce Sombre* (Prerog. Court, Jan. 7, 1856), dated in June 1849, the litigation took place on account of the insanity of the testator at different dates up to the year 1842. The deceased was the subject of numerous inquisitions, some of them undertaken at his own request, and the results were variable. On some of these inquiries he was pronounced to be sane and competent to manage his affairs—an opinion entertained also by some English and French physicians. By others, again, it was considered that during the whole period of seven years his mind was still infected with certain delusions respecting his wife and her relations. Dr. Seymour and Dr. Olliffe, who had been attesting witnesses to some of the testamentary papers, considered him to be of sound mind at the time of signing them. This, however, might be consistent with the existence of some delusion in reference to the disposition of his property. Sir John Dodson, in delivering judgment, said:—'A person might manage his property exceedingly well to a certain extent, and yet be labouring under insane delusions; and any insane delusion whatever operating on his mind would, according to the law and practice of the Court, render him incapable of making a will. But, supposing these gentlemen thought him capable in June and in August 1849, what was to be said as to the publication of a book by the deceased called the "Refutation," which took place very shortly afterwards, and which must have been in preparation when the will and codicil were executed? It contained statements which showed that the deceased could not have been of sound mind when he composed it. Under these circumstances, the Court could come to no other conclusion than that he laboured under insane delusions in 1843, and that he continued to entertain them when the papers propounded were executed.' The Court therefore pronounced judgment against the will and codicil. In this case the delusions had never been entirely eradicated from the mind of the testator. There is, however, a difference between unsoundness of mind represented by incompetency to manage affairs, and that defect of mind which deprives a man in a legal sense of the power of disposing of his property by will. A mind may be clear enough for the performance of some of its functions, and yet not clear enough for the performance of others. A man may give clear and reasonable directions for the preparation of a will, and even sign it in a natural manner, but he may be governed by caprice and passion amounting to insanity in the disposition of his property. It has been well remarked that 'so long as human nature is the mysterious phenomenon that it is, and the empires of reason and unreason border so closely on each other, we must expect often to err when we try to discover whether a man, alternately the subject of both, was in or out of his mind at any given moment.' A disposing power may exist in the mind of a person not legally competent to manage his affairs. The criteria applied are different, and the existence of such a power must be a matter to be proved by evidence in each particular case.

Eccentricity in wills.—The evidence in these cases sometimes amounts to proof of eccentricity only on the part of the testator, or in the deed itself; but a clear distinction must be here drawn. The will of an eccentric man is such as might always have been expected from him: the will of one labouring under insanity (delusion) is different from that which he would have made in an unaffected state—the instrument is wholly different from what it would once have been. It has been justly observed, that the insane are eccentric in their ideas, their language, or their conduct; but the merely eccentric have but a voluntary resemblance to the insane. (Jamieson's Lectures, 'Med. Gaz.' vol. 46, p. 180.) In the case of a *Mr. Stott*, a medical electrician, whose will was disputed by his daughter on the ground of insanity, it was proved that the testator fancied he could deliver pregnant women by means of electricity; and he actually proposed to the wife of a baker living in the neighbourhood, to bring about her accouchement by a number of wires connected with an electrical machine! The will was pronounced invalid, not so much on account of this absurdity, as of the violent and unnatural treatment to which he had subjected his daughter. It appeared that he had taken, as we now and then find in monomaniacs, a most unaccountable and causeless dislike to this girl from her earliest infancy. Strange as it may appear, electricity has been lately used as a means of aiding parturition, but under circumstances very different from those which gave rise to the absurd delusion in the case just related. ('Med. Gaz.' vol. 36, p. 376.) It has become a grave question whether proof of *moral insanity*, *i. e.* a perverted state of the moral feelings, sentiments, or affections, independently of any direct evidence of *intellectual* disturbance, should be a sufficient ground to set aside the act of a testator (p. 1021). In the case of *Frere* v. *Peacocke* (Prerogative Court, Oct. 1845), this was the principal question at issue. The counsel who maintained the validity of the will argued against the admissibility of Pinel's doctrine of moral insanity, chiefly because there was a difference of opinion, among those who adopted the doctrine, whether it was or was not invariably accompanied by some mental derangement. A doctrine thus novel, unsettled, and not sufficiently developed could not, it was urged, be safely applied to legal questions. If a man who was free from delusion (as the deceased in this case was), and capable of acts of business (as he was), might nevertheless be held to have been insane, it would involve this branch of testamentary law in utter confusion. A man who was not a subject for a Commission of Lunacy might be held after death to have been morally insane. The Court would have to deal with cases of kleptomania and pyromania, in which the persons exhibited no trace of intellectual insanity or delusion of mind. It was safer to rely upon the ancient and general doctrine of these Courts, *that there was no insanity without delusion—its true criterion*—and that in the present case the deceased, though eccentrical, was not of unsound mind. The Court found that the will was valid, and that there was no proof of delusion or of insanity, either sentimental or intellectual. The deceased was a most unamiable being; but still his acts were not irrational, nor inconsistent with soundness of mind. (Prerog. Court, Aug. 1846.) In no case probably has eccentricity come so near to insanity as in this.

Wills are sometimes contested more on the ground of eccentricity than of insane delusion; but if eccentricity only be proved, a Court will not interfere. In the case of *Morgan* v. *Boys* (1838), it was proved that the testator, by his will, had left a large fortune to his housekeeper. The will was disputed on the ground that it bore intrinsic evidence of the deceased not having been in a sane state of mind at the time of making it. After having bequeathed his property to a stranger, the testator directed that his executors should 'cause some parts of his bowels to be converted into fiddle-strings,—that others should be sublimed into smelling-salts, and that the remainder of his body should be vitrified into lenses for optical purposes'! He further added, in a letter attached to his will,—'The world may think this to be done in a spirit of singularity or whim; but I have a moral aversion to funeral pomp, and I wish my body to be converted into purposes useful to mankind.' Sir H. Jenner, in giving judgment, held that insanity was not proved: the facts merely amounted to *eccentricity*, and on this ground he pronounced for the validity of the will. It was proved that the deceased had conducted his affairs with great shrewdness and ability; that he not only did not labour under imbecility, but that he had been always treated during life as a person of indisputable capacity by those with whom he had to deal. The best rule to guide the Court, the Judge remarked, was the conduct of persons towards the deceased; and the acts of his relatives evinced no distrust of his sanity or capacity while he was living. The deceased had always been noted for his eccentric habits, and he had actually consulted a physician upon the possibility of his body being devoted to chemical experiments after death. In the case of *Mudway* v. *Croft* (Prerog. Court, Aug. 1843), a will contested on the ground of insanity but defended on the plea of eccentricity, Sir H. J. Fust said,—'It is the prolonged departure, without an adequate external cause, from the state of feeling and modes of thinking usual to the individual when in health, that is the true feature of disorder of the mind.' See also the case of *Waring* v. *Waring* (Prerog. Court, Feb. 1847).

The case of *Yglesias* v. *Dyke* (Prerog. Court, May 1852) presents some singular points of interest in reference to the distinction between eccentricity and insanity. The testatrix bequeathed by her will a considerable amount of property, which, as she was illegitimate, and as it was alleged incompetent to make a will, was claimed by the Crown. It was proved that she was of dirty habits, and among other facts that she kept fourteen dogs of both sexes, which were provided with kennels in her drawing-room! Two of the dogs slept in the same room, and one, which was blind, slept in the same bed with her! The testatrix also had a propensity for guinea-pigs, and was subject to some singular delusions. Some evidence was adduced to show that, in spite of these strange freaks, she was able to manage her own affairs; but the Court pronounced against the validity of the will, on the ground that the testatrix had for a long period laboured under insane delusions, and there was no proof that these had ceased. Her eccentricity was the result of insanity. Nothing, however, is more common than to find this propensity for animals existing among sane childless women who live solitary or secluded lives. One old lady whom I knew generally kept her sitting-room full of monkeys, to the great annoyance of her visitors. She was a woman of good family, and of a shrewd and strong mind, well able to look after her affairs and to dispose of her property. She was considered to be eccentric, but there was no trace of insanity about her. Other women are not happy unless surrounded by parrots, or unless their sitting-rooms are converted into aviaries for all kinds of birds. In *Re Cumming*, it was alleged that the lady whose sanity was disputed had a strong propensity for cats; these animals being provided with meals at regular hours, and furnished with plates and napkins. In this case a verdict of insanity was returned, not so much on account of the special attention shown to the cats, as from her acts in reference to her property and from her association with certain persons who appear to have taken advantage of her intellectual weakness. The fact is, this propensity for animals proves nothing in relation to the existence of insanity, unless there is at the same time good evidence of intellectual aberration. (See the case of *Dryden* v. *Fryer*, Q.B. Dec. 1850, 'Journal of Psychol. Med.,' 1851, p. 285.)

To these may be added the following case, which was the subject of litigation in Paris in 1864. A wealthy Portuguese gentleman named *Machado* died in 1861, having made a will with seventy-one codicils attached to it, some of them containing provisions impossible of execution. It was disputed on the ground of the insanity of the testator. One of the codicils was to this effect: 'I leave for the Athenæum of Paris 10,000 francs, the interest of which at 5 per cent. will be 500 francs. Half of this interest to be paid to a Professor of Natural History, who shall lecture on the colours and patterns of dresses, and on the characters of animals.' Again: 'My funeral shall take place at 3 P.M., the hour at which the rooks of the Louvre come home to dinner.' The testator was especially fond of birds: he desired that many stuffed specimens should be placed in his coffin; that his servant should carry to the ceremony 'one of my favourite birds in his cage;' and that certain birds should be let loose on the day of his funeral. The testator had during his life erected his own tomb, on which were engraved a sun, a bird, an ox, and a dog, an egg 'proper' surmounting them; beneath was inscribed, 'Here reposes the author of the "Theory of Likeness."' These and other facts of a similar kind were relied upon as proofs of insanity, but it was decided that the deceased was only vain, not insane, and therefore he had a right to will away his property as he pleased. It was proved in favour of his sanity that in spite of these crotchets he had while living managed his affairs with all the caution of a sane person.

Wills in senile dementia.—Wills made in incipient dementia arising from extreme age (senile imbecility) are sometimes disputed, either on the ground of mental deficiency, or from the testator, owing to weakness of mind, having been subjected to control and influence on the part of interested persons. If a medical man be present when a will is executed, he may easily satisfy himself of the state of mind of a testator, by requiring him to repeat from memory the mode in which he has disposed of the bulk of his property. A medical man has sometimes placed himself in a serious position by becoming a witness to a will without first assuring himself of the actual mental condition of the testator (case of the *Duchess of Manchester*, p. 1086). It would always be a good ground of justification, if, at the request of the witness, the testator had been made to repeat substantially the leading provisions of his will from memory. If a dying or sick person cannot do this without prompting or suggestion, there is reason to believe that he has not a sane and disposing mind. It has been observed on some occasions, when the mind has been weakened by disease or infirmity from age, that it has suddenly cleared up before death, and the person has unexpectedly shown a disposing capacity. ('Ann. d'Hyg.' 1831, p. 360.) In *Durnell* v. *Corfield* (Prerog. Court, July 1844), where an old man of weakened capacity had made a will in favour of his medical attendant, Dr. Lushington held that there must be the clearest proof not only of the *factum* of the instrument, but of the testator's knowledge of its contents. ('Law Times,' July 27, 1844.) In *West* v. *Sylvester* (Nov. 1864), Sir J. Wilde, in pronouncing judgment against a will propounded as that of the deceased, an aged lady, said:—'At the time she executed the will of October 1863, although for many purposes she might be said to be in her right senses, she was nevertheless suffering from that failure and decrepitude of memory which prevented her from having present to her mind the proper objects of her bounty, and selecting those whom she wished to partake of it.'

I am indebted to a learned judge for the following note:—'Another condition may be noticed, which often occurs in the experience of lawyers, and to which medical gentlemen in attendance on aged persons, do not sufficiently attend. A person's mind in extreme old age may be quite intelligent, his understanding of business clear, his competency to converse upon and transact such, undoubted, and his bodily strength good: but there may grow upon him such a fear and dread of relatives or servants who may have surrounded him, and on whom he may have become perfectly dependent, that his nervous system is wholly overcome, and he becomes a mere child and tool in the hands of those about him, so that he has no power to exert his mind in opposition to their wishes, or to resist their importunities. His mind is enslaved by his fears and a feeling of helplessness, so that to that extent, and in matters in which he may be moved by them, he really is facile and imbecile. This state of things seems to be easily brought on in old age, when the faculties are otherwise entire and the bodily strength considerable. This condition of mind at a great age (93 or 94) was exhibited in a remarkable manner in a case from Scotland, which went to the House of Lords (*Cairns* v. *Marienski*).

Wills 'in extremis.'—Wills made by persons whose capacity during life has never been doubted, while lying at the point of death, or, as it is termed, *in extremis*, are justly regarded with suspicion, and may be set aside according to the medical circumstances proved. Many diseases, especially those which affect the brain or nervous system directly or indirectly, are likely to produce a dulness or confusion of intellect, under which a disposing power is lost. Delirium sometimes precedes death, in which case a will executed by a dying person would be at once pronounced invalid.

In examining the capacity of a person under these circumstances, we should avoid putting leading questions—namely, those which suggest the answers 'yes' or 'no.' Thus, a dying man may hear a document read over, and affirm, in answer to such a question, that it is in accordance with his wishes, but without understanding its purport. This is not satisfactory evidence of his having a disposing mind: we should see that he is able to dictate the provisions of the document, and to repeat them substantially from memory when required. If he do this accurately, there can be no doubt of his possessing complete testamentary capacity. But it may be objected that many dying men cannot be supposed capable of such an exertion of memory: the answer is then very simple; it is better that the person should die without a will, and his property be distributed according to the law of intestacy, than that, through any failing of the mind, he should unknowingly cut off the rights of those who have the strongest claims upon him.

Restriction of medical opinions.—In an important case (*Bainbrigge* v. *Bainbrigge*, Oxford Summer Ass. 1850), tried before Lord Campbell, in which the testamentary capacity of the testator was disputed, it was held that a medical witness, although conversant with cases of insanity, cannot be asked his opinion as to the insanity of a testator founded upon the evidence given at the trial in his hearing. (4 Cox, 'Criminal Cases,' 454: see also on this subject 'Med. Gaz.' vol. 46, p. 240.) In the case of the *Duchess of Manchester*, however (*ante*, p. 1086), the opinions of Drs. Sutherland, Mayo, and Conolly, on the competency of the testatrix, were received by the Court, although based upon the evidence given at the trial.

CHAPTER 85.

THE PLEA OR DEFENCE OF INSANITY—CIRCUMSTANCES UNDER WHICH IT IS ADMISSIBLE—HOMICIDAL MONOMANIA—MORAL INSANITY—CAUSES—SYMPTOMS—LEGAL TESTS—MEDICAL TESTS—MOTIVE—CONFESSION—ACCOMPLICES—DELUSION—SUMMARY—TESTS OF IRRESPONSIBILITY—CASES IN ILLUSTRATION—SUMMARY OF MEDICAL EVIDENCE.

The plea or defence of insanity.—Responsibility here signifies nothing more than liability to punishment for crime, and a criminal act implies the existence of intention, will, and malice. (Stephen.) When insanity has reached a certain stage or degree, an act may be perpetrated without malice; and in this sense the person is considered to be irresponsible in law. This is a question of *fact*, to be determined by a jury from the whole evidence set before them; and the proof rests with those who make the allegation that the act in question, whether murder or arson, was not done wilfully and maliciously. 'The sanity of a man's conduct,' observes Mr. Stephen, 'involves the presence of intention and will on all ordinary occasions; and if the act is one of those which the law forbids, it is presumed to be malicious and wicked.' ('Criminal Law of England,' p. 89.) This subject is of considerable importance in a medico-legal view; for should a plea of insanity be improperly admitted in any criminal case, then punishment is made to fall unequally on offenders; and if, on the other hand, it be improperly rejected, punishment is administered with undue severity. The rule of law on this subject is that no man is responsible like a sane person for any act committed by him while in a state of insanity. The plea may be raised for the smallest offence up to the highest crime—murder; but it is rarely made a defence in smaller offences, because the close confinement to which an accused person, if found insane, would necessarily be subjected, would often be a heavier punishment than that which the law actually prescribes for the offence which he may have committed. In a case of felonious assault, it was urged by counsel in defence that the prisoner was insane; but the evidence on this point was not by any means conclusive,—when it was intimated by the Court that, if this plea were admitted, the party would probably undergo a much longer imprisonment than if on conviction he received the legal punishment for the offence! (The *Queen* v. *Reynolds*, Bodmin Aut. Ass. 1843.) The judge is reported to have said that there was no proof of insanity. If the prisoner was pronounced insane, he might be imprisoned for life, and therefore he did not think *that* finding would benefit him! A verdict of guilty was returned, and the man was sentenced to eighteen months' imprisonment. This case shows that a defence of this kind may be sometimes indiscreetly put forward. Such a mode of dealing with the plea of insanity, *i.e.* of making it a question of expediency dependent on the amount of punishment for the offence, must be pronounced as unsafe and indefensible. Murder, incendiarism, and theft are the crimes for which the plea of insanity is commonly raised; and it has been generally confined in this country to those cases in which persons have been charged with murder or attempts at murder.

Murder may be perpetrated by one who is obviously labouring under delirium or violent mania, or by an idiot or imbecile. Apart from the circumstances connected with the criminal act, there may be evidence of such a disordered state of mind in the person as at once to exonerate him from that amount of responsibility which is exacted from one who is sane. The appearance of the accused, or the testimony of a medical man, renders it unnecessary to go into the evidence, and a verdict is returned accordingly. The cases of difficulty are those in which insanity presents itself in a doubtful aspect, as in mania or imbecility. The mental disorder may be of so slight a nature as not legally to justify an acquittal for murder. In order to exculpate a person it must be proved that insanity in a certain degree existed at the time of the perpetration of the act. Whether the prisoner is or is not insane when placed on his trial is immaterial in reference to the question of responsibility. In the case of *Murray* (tried before the High Court of Justiciary, Edinburgh, Nov. 1858), it was proved that the accused recovered his sanity eight hours after he had killed the deceased; but he was acquitted on the ground of insanity at the time of committing the act.

In *Reg.* v. *Pate* (tried in 1850, at the Central Criminal Court) the prisoner was indicted for an assault on the Queen. It was proved that he had been guilty of strange and eccentric and even of that which some might call insane conduct, but there was no evidence to show that he had not a rational control over his actions. Dr. Conolly admitted that the prisoner was labouring under no delusion, that he knew the distinction between a right and a wrong action, but he was subject to sudden impulses of passion. He attributed his act to some sudden impulse which he was quite unable to resist. Other witnesses deposed that in their opinion, although the prisoner was fully conscious of his act, he was *insane*. The late Baron Alderson, who tried the case, observed, in charging the jury, 'that it was not because a man was insane that he was unpunishable; and he must say that upon this point there was generally a very grievous delusion in the minds of medical men. The only insanity which legally excused a man for his acts, was that species of delusion which conduced and drove him to commit the act alleged against him. They ought to have proof of a formed disease of the mind, a disease existing before the act was committed, and which made the person accused incapable of knowing, at the time he did the act, that it was a wrong act for him to do.' The jury convicted the prisoner, and he was sentenced to transportation. ('Med. Gaz.' vol. 46, p. 152; and 'Journ. Psychol. Med.' 1850, p. 557.) The defence of insanity was here, it appears to me, advanced upon very weak grounds. Had the prisoner assaulted a policeman instead of the Queen, he would have been fined or imprisoned, and nothing heard of the plea, although the rank of the person assaulted can make no difference respecting the existence or nonexistence of a diseased state of mind. (See some remarks on this case by Dr. Forbes Winslow, 'Journ. Psychol. Med.' 1859, p. 445.)

From the remarks of the learned judge it would appear that the existence of one degree of insanity admits of punishment for crime, while the existence of another degree excuses it. As it has been already remarked in speaking of testimonial capacity, nothing can be more incorrect than to apply one general term (*insanity*) to the conditions of all persons affected with mental disorder, and to pronounce them therefore all incompetent or all incapable, when common sense suggests that we are bound to inquire into the amount of capacity in each case. If all persons are to be excused from responsibility for crimes or offences because they entertain certain delusions, or because they are guilty of eccentricity, it would be better at once to make one general rule, and render all their civil acts void, and at the same time give them the benefit of irresponsibility for any criminal acts without inquiring into the *degree* in which insanity exists. Such a practice would hardly be compatible with the due exercise of justice, or with the safety of society. Admitting that in this case the accused was to a certain extent insane, there was a sufficient degree of sanity about him, as indicated by his general conduct before and after the event, to justify conviction and punishment. If, however, according to the ruling of the learned judge, we are always to insist upon distinct proof of a disease of the mind existing *before* the act committed, it is clear that an act perpetrated under a sudden access of insanity, by a person not previously labouring under delusions, would be punishable like that of a sane criminal. Dr. Wood, who has written on this subject, repudiates the doctrine that an insane person is necessarily irresponsible, and therefore unpunishable: 'All who have had the opportunity of studying insanity know full well that, with comparatively few exceptions, insane persons are not only powerfully influenced, but materially controlled, by the same motives which influence and control those who are still mixing in the world, and who have never been suspected of mental derangement.' ('Plea of Insanity,' 1851, p. 4.)

In *Reg.* v. *Burton* (Maidstone Lent Assizes, 1862), Mr. Justice Byles observed that even the existence of mental disease did not necessarily exempt a person from criminal responsibility. Many a man whose mind is in an unsound state knows perfectly well whether he is doing wrong; and so long as he knows *that*, he is subject to the criminal law. A writer on this subject justly remarks:—'Even morbid delusion cannot always be allowed to screen a criminal from the consequences of his own acts, while there are instances in which a plea of insanity may properly be allowed, although no such delusion can be proved. Each case must be taken with its circumstances, and legal theories of insanity are chiefly valuable, not as rigorous axioms of law, but as cautions to be observed by the jury.'

The great difference of opinion which exists between physicians and jurists in reference to this plea appears to me to consist in this:—Most jurists aver that no degree of insanity should exempt from punishment for crime, unless it has reached that point *that the individual is utterly unconscious of the difference between right and wrong at the time of* committing the alleged crime. Physicians, on the other hand, affirm that this is not a proper test of the existence of that degree of insanity which should exempt a man from punishment; that those who are labouring under confirmed insanity, and who have been properly confined in asylums for years, are fully conscious of the difference between right and wrong, and are quite able to appreciate the illegality as well as the consequences of their acts. Again, those who have patiently watched the insane for years, agree that the legal test of utter unconsciousness of right and wrong in the performance of acts would in reality apply only to persons who were suffering from delirium, from a furious paroxysm of mania, or from confirmed idiocy; and that if the rule suggested by Mr. Warren—that a person, in order to be acquitted on the ground of insanity, should be first proved to be as *unconscious* of his act *as a baby*,—were strictly carried out, there is scarcely an inmate of an asylum who happened to destroy a keeper or attendant who might not be executed for murder. Such a rule amounts to a *reductio ad absurdum*; it would abolish all distinction between the sane and the insane, between the responsible and the irresponsible; and it would consign to the same punishment the confirmed lunatic and the sane criminal. This species of *baby-unconsciousness of action* exists in idiots as well as in furious maniacs, but not in the majority of lunatics; and it may be safely asserted that, if this criterion be the true one, acquittals on the ground of insanity have involved a series of gross mistakes for the last fifty years. The only irresponsible lunatics, according to Mr. Warren, are precisely those who would not even have reason enough to plead to an indictment. Thus, while the medical profession is condemned for adopting opinions which would lead to the acquittal of criminals, this writer recommends a rule which would certainly lead to the execution of the greater number of confirmed lunatics charged with acts of homicide. The practical failure of such a rule is manifest when it is found that persons who have destroyed life with a perfect consciousness of the wrongfulness of their acts are frequently acquitted. In the case of *Dadd*, who was acquitted on the ground of insanity, and who was proved to be a confirmed lunatic, it transpired that the man had actually provided himself with a passport and fled to France after destroying his father! (See Wood on the 'Plea of Insanity,' p. 41.) It may be said that the consciousness of the insane is an insane consciousness, while the law implies the consciousness of a sound mind; but this involves a *petitio principii.* There have been numerous cases of acquittal in which, until the act of homicide was committed, there was no imputation either against the sanity or the sane consciousness of the accused.

Having pointed out these inconsistencies, it is only proper to acknowledge that in theory the English law would punish a lunatic just as it would punish a sane man, provided the lunatic 'had that degree of intellect which enabled him to know and distinguish between right and wrong, or what was lawful and unlawful; if he knew what would be the effects of his crime, and consciously committed it; and, further, if with that consciousness he wilfully and intentionally committed it.' In practice, however, it is placed beyond doubt that some who ought to be convicted under these rules are acquitted on the legal fiction that they were at the time unconscious (or only insanely conscious) of the wrongfulness of their acts. Dr. Wood states that of thirty-three males confined as lunatics in Bethlehem who had actually committed murder, not including those where an unsuccessful attempt was made to perpetrate the same crime, *three* were reported sane; he feels quite satisfied that two of these were *not insane* at the time they committed the murders, and of the fifteen males who had actually committed murder, five were reported sane, and two of them ought in his judgment never to have been acquitted on the ground of insanity. ('Plea of Insanity,' p. 50.) According to Dr. Hood, in the six years from 1852 to 1858, 120 persons who were tried for murder, or for attempt at murder or acts of personal violence, were acquitted on the ground of insanity. Of that number, 79 were received into Bethlehem Hospital, and in several instances they exhibited no symptoms of insanity while they were resident in the asylum. These facts, then, are sufficient to show that the rule of law generally adopted does not err on the side of severity. The only complaint that can be made is, that it operates with uncertainty. This question has been fully and ably examined by Dr. Bucknill. ('Unsoundness of Mind in Relation to Criminal Acts,' 1854, pp. 5, 16, 39.)

The defence of insanity in cases of murder by poison has generally ended in failure, although there may even have been proof of hereditary taint. (*Reg.* v. *Gallop*, Somerset Winter Assizes, 1844; and *Reg.* v. *Allnutt*, Cent. Crim. Court, Dec. 1847.) The crime of poisoning indicates malice and deliberation in a greater degree than it would be in general safe to admit as co-existing with a state of irresponsible insanity. Alison, however, mentions one case of acquittal (*Sparrow*, 1829) in which this plea was admitted. The woman poured a large quantity of vitriolic acid down the throat of her own child; she then ran to a neighbour's house in a state of evident derangement, saying that she had killed the devil. This was a case of demonomania; her insanity was clearly proved, and she was acquitted. ('Crim. Law,' p. 648.) In *Reg.* v. *Vyse* (Cent. Crim. Court, July 1862) the prisoner, a respectable woman, was charged with the murder of her two children, by poisoning them with strychnia. The act was done with great deliberation and forethought, the poison was purchased under false pretences, and there was an entire absence of motive. She was acquitted on the ground of insanity. This was considered to be a case of impulsive mania, as there was nothing to indicate intellectual insanity. There was an hereditary tendency to insanity, coupled with the effects of prolonged nursing and general constitutional debility; but Dr. Hood's minute inquiries brought out facts which clearly showed that the prisoner had laboured under disease which might have affected her mind and have deprived her of the proper control of her actions. He states that on his first visit to her in Newgate he learnt that during the latter months of suckling she had been mentally overworked and subjected to great anxiety and fatigue. When worried by her business-transactions she suffered from a painful sensation seated in the interior of the cranium, on the surface of the brain, and which she spoke of as 'perspiring of the brain'—a symptom often complained of by patients who suffer from mental disease as giving a creeping, irritating feeling, but never more graphically described than by Mrs. Vyse. It is indicative of morbid action or secretion of the membranes of the brain, which is manifested by examination after death. He considered Mrs. Vyse to be suffering from cerebral disease, which rendered her at the time of the murder an irresponsible agent. The impulse to violence may be dormant for weeks or months, and then show itself by a suicidal or homicidal act; but such is the result and not the proof of mental disease.

When a defence of insanity is set up, in a charge of murder, in order to warrant the jury in acquitting a prisoner, it must be proved affirmatively that he is or was *insane in a certain legal sense*: if this fact be left in doubt, and if the crime charged in the indictment be proved, it is their duty to convict him. (*Reg.* v. *Stokes*, 3 Car. and Kir., p. 185.) The witness must remember that it is not medical but legal insanity which has to be proved to the satisfaction of the jury. In examining an accused party who is alleged to have committed a crime while labouring under insanity, the plea may be good, and yet the person be *sane* when examined. This was observed in the case of a lunatic who killed his mother in February 1843; there was no doubt that he was insane at the time of the act, but two days afterwards he was found to be of perfectly sound mind. This sudden restoration to reason is sometimes met with in cases of homicidal mania. For a remarkable instance of this description, where the motive of a man in killing his wife was apparently jealousy, see report by MM. Leuret and Ollivier ('Ann. d'Hyg.' 1843, vol. 2, p. 187; also 1836, vol. 2, p. 122). Lord Hale mentions a case in which a woman, soon after her delivery, killed her infant; she confessed the crime, was carried to prison, fell into a deep sleep, awakened quite sane, and wondered how she came there. (See also the case of *M'Callum*, Alison, p. 650.) It is customary to say that they who commit these heinous crimes while labouring under insanity are irresponsible. By this we are not to understand that they are allowed to go free; on the contrary, they are subjected to a close confinement—perpetual in all cases of murder, but depending on their recovery in respect to crimes of less magnitude. A power is vested in the Executive only to discharge recovered criminal lunatics, according to circumstances. A large asylum has been recently established by Government at Broadmoor, for the reception of all criminal lunatics; and those who have been acquitted of murder on the ground of insanity, after having once entered this establishment, are as dead to the world as if the earth had closed over them. Beyond the walls, whether sane or insane, the murderers once committed to Broadmoor never pass, either in life or after death. A writer who visited this establishment in the early part of 1865 found there 400 men and about 60 women, and he calculated that the victims of their united crimes amounted to nearly 1,000 persons!

HOMICIDAL MONOMANIA.

Homicidal mania or monomania is commonly defined to be a state of partial insanity, accompanied by an *impulse* to the perpetration of murder: hence it is sometimes called impulsive or paroxysmal mania. There may or may not be evidence of *intellectual* aberration, but the main feature of the disorder is the existence of a destructive impulse which, like a delusion, cannot be controlled by the patient. This impulse, thus dominating over all other feelings, leads a person to destroy those to whom he is most fondly attached, or any one who may be involved in his delusion. Sometimes the impulse is long felt, but concealed and restrained: there may be merely signs of depression and melancholy, low spirits and loss of appetite, as well as eccentric or wayward habits, but nothing to lead to a suspicion of the fearful contention which may be going on within the mind. As in suicidal mania, many of those who are in habits of daily intercourse with the patients have been first astounded by the act of murder, and then only for the first time led to conjecture that certain peculiarities of language or conduct, scarcely noticed at the time, must have been symptoms of insanity. Occasionally the act of murder is perpetrated with great deliberation, and apparently with all the marks of sanity. These cases are rendered difficult by the fact that there may be no distinct proof of the existence, past or present, of any disorder of the mind, so that the chief evidence of mental disorder is the *act* itself: of the existence of insanity, in the common or legal acceptation of the term, before and after the perpetration of the crime, there may be either no evidence whatever, or it may be so slight as not to amount to proof. Such cases are regarded and described by some medico-legal writers as instances of *insanity of the moral feelings* only, and this condition has been called '*Moral insanity*' (*ante*, p. 1022.) Its existence, as a state independent of a simultaneous disturbance of the reason or intellect, is denied by the great majority of lawyers as well as by some eminent medical authorities. In reference to criminal responsibility, it is considered to imply a loss of power on the part of the affected person to distinguish between right and wrong, or the legality or illegality of an act. Whether such a condition exists or not is a simple question of fact, to be established if possible by clear and conclusive evidence. Its existence in the case of a person charged with murder appears to have rested hitherto on a mere medical dictum. Intelligible reasons have not been assigned by those witnesses who have sought to satisfy a Court of Law that this has as distinct an existence as intellectual insanity; in general, it is only alleged and not proved to exist in a given case. If its existence were satisfactorily established, it would, as Mr. Stephen observes, do away with one of the essential ingredients of crime — malice, and thus justify a jury in acquitting a person charged with murder. The accused on these occasions is assumed to have been an involuntary agent. As Mr. Stephen suggests, it might be a good defence to admit that a man loaded a pistol and pointed it at the head of another, but that it was fired by a sudden involuntary action of the necessary muscles, and not by the prisoner's will. The only difficulty is to get a jury to believe it. The evidence given in support of the assertion that a man is morally insane is, generally speaking, at least as consistent with the theory that he is a great fool and a great rogue, as with the theory that he is the subject of a special disease the existence of which is doubtful. ('Criminal Law,' p. 95.) There is no doubt that the unrestricted admission of such a theory would go far to do away with all punishment for crime, for it would render it utterly impossible to draw a line between (moral) insanity and moral depravity. What is crime but the perversion of moral feelings? Moral insanity in a person of *sound mind* is a contradiction in terms; whenever the mind is sound, a man's conscience and sense of right and wrong will always be sufficient to enable him to restrain evil desires and impulses. It appears to me that the great difference of opinion which exists on the subject between legal and medical authorities, turns rather upon the signification of words than upon any disagreement on the facts or the practical inferences to be drawn from them.

Causes.—The causes of homicidal monomania are assigned by Esquirol to cerebral irritation induced by bodily disease, long watching, excessive nervous excitement, vicious education, erroneous notions of religion, grief, destitution, and the power of imitation. With respect to the latter, it is a fact that the publicity given to horrible occurrences often excites a homicidal feeling in persons of weak minds. The sight of a weapon or of the intended victim, also determines in an instant the perpetration of the act—the person feeling himself drawn on by an irrational impulse which he can neither resist nor control. Disordered menstruation, owing to sympathy of the brain with the uterus, may likewise operate as a cause; and this it is the more important to observe, because the person affected may not have previously manifested any sign whatever of intellectual disturbance. (Case of *Brixey*, p. 1109.) *Amenorrhœa* (suppressed menstruation) may be a latent cause of insanity among girls, especially in those cases in which there is any hereditary predisposition to the disorder. Such cases announce themselves by the non-appearance or long cessation of the menstrual function while the ordinary symptoms of chlorosis indicate the existence of this state. (Millar.) By the sympathy of the uterine functions with the brain there may be some intellectual disturbance, indicated by waywardness of temper, strange and immoral conduct, morbid appetite, and great irritability with excitement from slight causes. A crime may be suddenly perpetrated by such persons without apparent motive; and if clear proof of intellectual disorder before the occurrence be in all cases required, there is often no alternative but to convict the person as a sane criminal. Esquirol alludes to the case of a female, who at every menstrual period experienced a strong desire to kill her husband and children, especially when she saw them lying asleep. Parturition and suppressed lactation are likewise causes, and in this case the disorder may assume the form of what is called PUERPERAL MANIA. It is important for a medical jurist to bear in mind that persons who are likely to be attacked by homicidal mania are not always characterized by a gloomy, melancholic, or irritable disposition; the disorder sometimes shows itself in those who have been remarkable for their kind and gentle demeanour and quiet habits. In these cases the murderous disposition may give no warning of its existence; this condition is, however, sometimes indicated by a change of character corresponding to a sudden access of insanity.

Symptoms.—Homicidal mania, in its more common form, may make its appearance at all ages, even in children:—it is occasionally periodical, and the paroxysm of insanity is preceded by symptoms of general excitement. The patient experiences colicky pains, and a sense of heat in the abdomen or chest,—headache, restlessness, and loss of appetite, lowness of spirits; the face is flushed or pale, the pulse hard and full, and the whole body is in a state of convulsive trembling. An act of violence is committed without warning, and the patient appears as if relieved from some oppressive feeling. He may be calm, and express neither regret, remorse, nor fear; he may coolly contemplate his victim, confess the deed, and at once surrender himself to justice. In some rare instances he may conceal himself, hide the weapon, and, like a sane criminal, endeavour to obliterate all traces of the crime—thus showing a perfect consciousness of the illegality or wrongfulness of the act, and a desire to evade discovery. These are the main features of crime, and unless there is independent evidence of mental disorder, or of some bodily disease affecting the brain, the conclusion must be that the person is sane and responsible. The great problem to be solved on these occasions is — What are the plain practical distinctions between defective reasoning power and perverted moral sense? The latter condition alone should not exculpate a person or absolve him from the usual punishment, or persons undeniably sane who have committed crimes should be equally exculpated and absolved from punishment.

The symptoms above described have been observed to be more aggravated in proportion as the homicidal impulse was strong. The propensity to kill is sometimes a fixed idea, and the patient can no more banish it from his thoughts than a person afflicted with insanity can divest himself of the delusive ideas which occupy his mind. (Esquirol, vol. 2, p. 105.) It has been supposed that Esquirol here implies a state in which there is no perversion of *intellect*. The facts which he mentions, however, clearly prove the contrary; for if a patient has not the power to banish from his thoughts this propensity to kill, he has passed beyond the bounds of reason, and is really insane. The admission of this fact proves that his mind must be unsound. Esquirol says—before the perpetration of the act there may be no sign of irrational conversation or conduct: but he asks the question—Because there is no proof of irrationality, are we to assume that these persons possess reason? Is it possible to reconcile the existence of a rational state of mind with the murder of those who are most dear to them? (Op. cit. vol. 2, p. 102.) In Esquirol's view, therefore, it may be taken that mere perversion of *feelings* (insanity), irrespective of some latent aberration of *intellect*, does not exist, and moral insanity is a conventional term for a state in which the proofs of mental disturbance are not so clear as in the generality of cases.

An erroneous notion prevails in the public mind, that a homicidal lunatic is easily to be distinguished from a sane criminal by some *certain* and invariable symptoms or characters, which it is the duty of a medical witness to display in evidence, and of a medico-legal writer to describe. But a perusal of the evidence given at a few trials will surely satisfy those who hold this opinion, that each case must stand by itself. It is easy to classify homicidal lunatics, and say that in one instance the murderous act was committed from a motive —*i.e.* revenge or jealousy; in a second from no motive, but from irresistible impulse; in a third from illusion or delusive motive—*i.e.* mental delusion; in a fourth from perverted moral feeling, without any sign of intellectual aberration. This classification probably comprises all the varieties of homicidal insanity, but it does not help us to ascertain, in a doubtful case, whether the act was or was not committed under any of these psychological conditions. It enables us to classify those who are *acquitted* on the ground of insanity, but it entirely fails in giving us the power to distinguish a sane from an insane criminal, or a responsible from an irresponsible lunatic. According to M. Esquirol, whose views, more or less modified, are adopted by all writers on the medical jurisprudence of insanity, the facts hitherto observed indicate *three degrees* of homicidal mania:—

1. In the *first* degree the propensity to kill is connected with absurd irrational motives or *actual delusion*. The person would be at once pronounced insane. Cases of this description are not uncommon, and they rarely create any difficulty. The case of *Reg.* v. *Wilson* (Lincoln Summer Assizes, 1864), referred to by Mr. Fitzjames Stephen, will furnish an illustration. A woman consulted a medical man as to pains in her head, loss of appetite, and low spirits after her delivery; she was also suffering from religious despondency. While in this state she got up in the night and drowned four of her children in a cistern. She gave this account of the act:—she washed the children, put them to bed, and retired herself about 10 o'clock, but could not sleep; and between 12 and 1 o'clock, it was suggested to her mind, as she says, by a black shadowy figure, that if they were in heaven they would be out of danger and better done to than she could do for them. It was still further suggested to her mind, in the same way, that she could easily put them into the cistern, and she at once proceeded to do so; it was better for them to die young than to grow up wicked. (See Stephen's 'Crim. Law of England,' p. 91.) The case of *Mrs. Brough*, who murdered six of her children at Esher, was somewhat similar in its details. This woman, at whose trial I attended on the part of the Crown, stated that while thinking of her children, during the night, a black cloud came over her which seemed to surround her and she felt compelled to kill them. (*Reg* v. *Brough*, Guildford Summer Assizes, 1854.) In other instances, those who have perpetrated such a series of murders, have stated that they had had the same sensation of darkness or a black spectre brooding over them just before the perpetration of the act.

2. In the *second* degree, the desire to kill is connected with *no known motive*. It is difficult to imagine a motive for the deed; the person appears to have been led on by some impulse. With respect to this class of cases, Mr. Stephen observes: 'There are motives for all acts even the maddest, but it is frequently impossible to assign them specifically. It is, however, generally possible to form an opinion whether a given act was done from some unknown mad motive, or from some unknown sane motive.' (Op. cit. p. 88.)

3. In the *third* degree, the impulse to kill is *sudden*, instantaneous, unreflecting, and *uncontrollable* (*plus forte que la volonté*). The act of homicide is perpetrated without interest, without motive, and often on persons who are most fondly loved by the perpetrator. (Esquirol 'Maladies Mentales,' vol. 2, p. 834.) It is this form, which has been called 'impulsive insanity,' which has given rise to so much contention on trials for murder in which insanity is set up as a defence, and therefore it will be well to consider this subject in a legal aspect. Mr. Stephen thus comments upon it:—'It is said that on particular occasions men are seized with irrational or irresistible impulses to kill, to steal, or to burn, and under the influence of such impulses they sometimes commit acts which would otherwise be most atrocious crimes. It would be absurd to deny the possibility that such impulses may occur, or the fact that they have occurred and have been acted on. Instances are given in which the impulse was felt and resisted. The only question which the existence of such impulses can raise in the administration of criminal justice, is whether the particular impulse was *irresistible* as well as *unresisted*. If it was irresistible, the person accused is entitled to be acquitted, because the act would not then be voluntary and not properly his act. If the impulse was *resistible*, the fact that it proceeded from disease would be no excuse at all. If a man's nerves were so irritated by a baby's crying that he instantly killed it, his act would be murder; it would not be less murder if the same irritation and corresponding desire were produced by some internal disease. The great object of the criminal law is to induce people to control their impulses; and there is no reason why, if they can, they should not control insane as well as sane impulses. The proof that an impulse was irresistible depends on the circumstances of the particular case. The commonest and strongest cases are those of women who, without motive or concealment, kill their children after recovery from childbed' (puerperal mania). (Op. cit. p. 95.)

The three forms in which a homicidal propensity may thus present itself in cases of insanity differ from each other only in degree — the two first being strongly analogous to but lighter modifications of the third. All the cases which came before M. Esquirol had these features in common — an irritable constitution, great excitability, singularity or eccentricity of character; and previously to the manifestation of the homicidal feeling there was a gentle, kind, and affectionate disposition. As in other forms of insanity, there was some well-marked *change of character* in the mode of life; and this may be taken as a proof that there must have been some degree of intellectual disturbance. The period at which the disorder commenced and terminated could be easily defined, and the malady could be almost always referred to some moral or physical cause. In two cases it was traced to the change produced by puberty, and in four to the power of imitation. Attempts at suicide preceded or followed the attack: all wished to die, and some desired to be put to death like criminals. In none of these cases was there any discoverable motive for the act of homicide.

M. Esquirol believes that there are well-marked distinctions between this state and that of the sane criminal. Among these he enumerates: 1. The want of accomplices in homicidal mania. 2. The sane criminal has *always* a motive—the act of murder is only a means for gratifying some other more or less criminal passion, and is almost always accompanied by some other wrongful act; the contrary exists in homicidal mania. 3. The victims of the criminal are those who oppose his desires or his wishes—the victims of the monomaniac are among those who are either indifferent to or who are the most dear to him. 4. The sane criminal endeavours to conceal, and if taken denies the crime; if he confesses it, it is only with some reservation, and when circumstances are too strong against him; but he commonly denies it to the last moment: it is the reverse with the monomaniac. The exceptions to which these characters are open will be considered hereafter. They have, undoubtedly, greater value in their combined than in their individual application, and when in any case they coexist, there is strong reason to believe that the person accused of murder is labouring under homicidal mania. The great difficulty in these cases, however, is to distinguish *moral depravity* from *insanity*. I agree with a medico-legal writer on this subject, that 'no hideousness of depravity can amount to proof of insanity, unsupported by some evidence of a judgment incapacitated, or of a will fettered by disease. In those cases of mental disorder in which the emotions are perverted, and where there is no clear proof of *deranged intellect*,—cases which do from time to time occur,—the presumption of insanity in regard to a criminal action has to be upheld by evidence of a suspension of the will. If it can be proved that the act was not voluntary, this does away with its criminal nature.' (Jamieson's Lectures on the Med. Jur. of Insanity, 'Med. Gaz.' vol. 48, p 181.) But it is impossible in many cases to produce satisfactory evidence of the suspension of the will: this suspension can only be *assumed* from the act,—a dangerous assumption, and one that might lead to the confusion of crime with insanity, and the exculpation of all criminals.

Legal tests.—Admitting the existence of homicidal mania as thus defined by Esquirol, it may become a question, how, when pleaded for one charged with murder, it is to be practically distinguished from a case in which the crime has been perpetrated by a really sane person. Tests, both medical and legal, have been proposed. The *legal test* was explicitly stated in the following terms by the whole of the judges in conference, in answer to queries put by the House of Lords on the case of *M'Naughten*, who was tried and acquitted on the ground of insanity (June 19, 1843):—

'Notwithstanding a party commits a wrong act while labouring under the idea that he was redressing a supposed grievance or injury, or under the impression of obtaining some public or private benefit, he is liable to punishment. The jury ought in all cases to be told that every man should be considered of sane mind until the contrary was clearly proved in evidence; that, before a plea of insanity should be allowed, undoubted evidence ought to be adduced that the accused was of *diseased mind*, and that at the time he committed the act *he was not conscious of right or wrong*. Every person was supposed to know what the law was, and therefore nothing could justify a wrong act, except it was clearly proved that the party did not know right from wrong; if that was not satisfactorily proved, the accused was liable to punishment. If the *delusion* under which a person laboured were only *partial*, the party accused was equally liable with a person of sane mind. If the accused killed another in self-defence, he would be entitled to an acquittal; but if the crime were committed for any supposed injury, he would then be liable to the punishment awarded by the laws to his crime.' ('Brit. and For. Med. Rev.' July 1843, p. 273.)

It would thus appear, that the law, in order to render a man responsible for a crime, looks for a *consciousness of right and wrong, and a knowledge of the consequences of the act*; while the administration of justice rests on the principle that every one knows the law and fears its punishment. Thus, the complete possession of reason is not essential to constitute the legal responsibility of an offender; and it is also to be inferred, from the results of several cases, that a man may be civilly incompetent, but sufficiently sane to be made criminally responsible. The proofs required in the two cases are essentially distinct.

It has been objected to this *legal test*, that it is insufficient for the purpose intended: it cannot, in a large majority of cases, enable us to distinguish the insane homicide fron the sane criminal. Many *insane persons* have committed acts which they knew to be wrong, and of the criminality of which they were at the time perfectly conscious. They have been known to murder others, in order to receive the punishment of death at the hands of the law; and therefore they must have been conscious of the wrongfulness, or rather of the illegality, of the act which they were perpetrating, and have known that they were committing an offence against the law of man. In short, the criminal nature of the act has often been the sole motive for its perpetration! ('Ann. d'Hyg.' 1852, vol. 1, p. 363.) It has been suggested, with some truth, that it is rather the imperfect or defective appreciation of the motives to right or against wrong action, which leads to crime among the insane, and not the mere ignorance of right and wrong. Most lunatics have an abstract knowledge that right is right and wrong wrong; but in true insanity the voluntary power to control thought and actions, and to regulate conduct by this standard, is impaired, limited, or overruled by insane motives. A lunatic may have the power of *distinguishing* right from wrong, but he has not the power of *choosing* right from wrong. A criminal is punishable not merely because he has the power of distinguishing right from wrong, but because he voluntarily does the wrong, having the power to choose the right. (Jamieson's Lectures on Insanity, 'Med. Gaz.,' vol. 46, p. 827.) The case of *Hadfield*, who was tried for shooting at George III. while sitting in his box at the theatre, and acquitted on the ground of insanity, furnishes an example of the existence of insane delusion, coupled with a knowledge of the consequences of the act which he was about to commit. He knew that in firing at the King he was doing what was contrary to law, and that the punishment of death was attached to the crime of assassination; but the motive for the crime was that he might be put to death by others,—he would not take his own life. Again, *Martin* the incendiary admitted that he knew he was doing wrong, according to the law of man, when he set fire to York Cathedral: he was conscious that the act was illegal, but he said he had the command of God to do it. Thus, then, we find that a full consciousness of the illegality or wrongfulness of an act may exist in a man's mind at the time of its perpetration, and yet, in spite of this, he may be legally acquitted on the ground of insanity. But it may be said this is an insane or delusive consciousness, and part of the insanity under which he labours. This is a mere assumption, not justified by the facts.

The legal test of a knowledge of the nature of the crime, or of right and wrong, is a frequent cause of inconsistent and even conflicting verdicts. The case of *Reg.* v. *Westron* (Central Criminal Court, February, 1856) furnishes a curious illustration of this. The prisoner was charged with the murder of a Mr. Waugh, a solicitor. On some provocation, partly real and partly based on an exaggerated view of his rights, the prisoner shot the deceased in open day in a public thoroughfare. The only question therefore for the jury was the state of mind of the prisoner. It was proved that he was ill-tempered and violent about trifles; but he had an acute knowledge of business, and lived by himself in various lodgings. The persons with whom he had associated deposed that his conduct was so strange and unreasonable at times, that they were glad to get rid of him as a lodger. Evidence was also given to the effect that several members of his family had been insane, and that the prisoner himself three years previously had suffered from mental excitement, but it was not such as to render restraint necessary. The medical witnesses declined to say—in answer to questions put by the learned judge and counsel—that the prisoner was in such a state of mind as to be incapable of knowing that the act of killing a man was wrong. Dr. Synnot properly observed that many lunatics would be perfectly well aware that such an act was wrong. On this it was contended, for the prosecution, that as the prisoner must have known of what he was doing, he was fully responsible. The jury were, as usual, directed to decide whether the prisoner was proved to have been in such a state of mind at the time the act was committed that he did not know the nature and quality of the act, or the distinction between right and wrong. Of course, upon the medical evidence the jury had no option but to find the prisoner guilty of 'wilful murder,' but they recommended him to mercy on account of an alleged predisposition to insanity. This verdict was tantamount to 'not guilty on the ground of insanity,' and sentence of death was therefore simply recorded. Under such a verdict the learned judges appear to have felt that the usual punishment of death for wilful murder could not be carried out. The jury were bewildered by the test of guilt submitted to them: they appear to have considered the man insane, but that his insanity had not reached the legal standard of an absence of knowledge of right and wrong. The general history of the prisoner and his crime tended to show insanity, but there was no reason to believe that it had reached that point at which there is a loss of all knowledge of the nature and quality of an act perpetrated, or of its unlawfulness. On the contrary, the prisoner deliberately shot the deceased out of revenge for a supposed injury; his whole conduct showed that he knew the act was illegal, but he set the law at defiance. A man actuated by mere brutal recklessness could have done no more.

Medical tests.—The *tests* which have been proposed by medical jurists for detecting cases of homicidal mania are as follows:—

1. The acts of homicide have generally been preceded by other striking *peculiarities of conduct* in the person,—often by a total change of character.

2. Those persons who are affected with it have in many instances previously or subsequently attempted *suicide*—they have expressed a wish to die or to be executed as criminals. These supposed criteria have been repeatedly and very properly rejected, when tendered as medical proofs of insanity in Courts of Law. They are of too vague a nature, and apply as much to cases of moral depravity as of actual insanity; in short, if these were admitted as *proofs*, they would serve as a convenient shelter from punishment for many sane criminals.

3. *Motive for crime.*—The acts are without *motive*; they are in opposition to all human motives. A man known to have been tenderly attached to his wife and children murders them,—a fond mother destroys her infant. It is hereby assumed or implied that persons who are sane never commit a crime without an apparent motive, and that in the perpetration of a criminal act an insane person either never has a motive, or has one of a delusive nature only. If these propositions were true, it would be easy to distinguish a sane from an insane criminal; but the rule wholly fails in practice. In the first place, the non-discovery is here taken as a proof of the non-existence of a motive; while it is undoubted that motives may exist for many atrocious criminal acts without our being able to discover them—a fact proved by the numerous recorded confessions of criminals before execution, in cases in which, until these confessions were made, no motive for the perpetration of the crime had appeared to the acutest minds. (*Reg.* v. *Hatto*, Bucks Lent Ass. 1854.) In the case of *Courvoisier*, who was convicted of the murder of Lord William Russell in June 1840, it was an undue reliance upon this alleged criterion, before the secret proofs of guilt accidentally came out, which led many to believe that this man could not have committed the crime; and the absence of motive was urged by his counsel as the strongest proof of his innocence. It was ingeniously contended 'that the most trifling action of human life had its spring from some motive or other.' This is undoubtedly true, but it is not always in the power of a man untainted with crime to detect and unravel the motives which influence criminals in the perpetration of murder. No reasonable motive was

ever discovered for the atrocious murders and mutilations perpetrated by *Greenacre* and *Good*, yet these persons were very properly made responsible for their crimes! It would be a fatal error to infer insanity from what is termed the inadequacy of motive.

In the inquiry whether a *particular* man committed the offence, the consideration of motive may be of great weight,—of very little, however, when the inquiry is whether the man who did it is insane. On the trial of *Francis* for shooting at the Queen, the main ground for the defence was, that the prisoner had no motive for the act, and therefore was irresponsible; but he was convicted. It is difficult to comprehend under what circumstances any motive for such an act as this could exist: and therefore the admission of such a defence would have been like laying down a rule, that evidence of the perpetration of so heinous a crime should in all cases be taken *per se* as a proof of the existence of an irresponsible state of mind! Crimes have been sometimes committed without any apparent motive by sane individuals, who were at the time perfectly aware of the criminality of their conduct. No mark of insanity or delusion could be discovered about them, and they had nothing to say in their defence; they have, however, been properly held responsible. On the other hand, lunatics confined in a lunatic asylum have been known to be influenced by motives in the perpetration of crimes: thus they have often murdered their keepers in revenge for ill-treatment which they have experienced at their hands, as in the case of the *Queen* v. *Farmer* (York Spring Assizes, 1837). This man was acquitted as insane, while the clear motive for the homicide was revenge and ill-feeling. In another instance the act of murder was perpetrated by a lunatic from a real motive of jealousy. (*Reg.* v. *Goule*, Durham Summer Ass. 1845.) On the whole, the conclusion with respect to this assumed criterion is, that an absence of motive when there are indications of insanity is a presumption in favour of the person being insane; but the non-discovery of a motive for a criminal act cannot of itself be taken as a proof of the existence of insanity or homicidal mania in the perpetrator. On the other hand, the fact that there exists such a motive (jealousy or revenge) as would instigate a sane man to an act of murder is not a proof that the person is sane and responsible.

The acts of the insane generally arise from motives based on delusion. In the state of idiocy an act of homicide has been committed merely as a result of imitation, and in imbecility, from motives of an absurd and unreasonable kind. I am indebted to Dr. Sutherland for some of the particulars of the case of a young man, affected with imbecility, upon whom an inquisition was held in 1843. He was a person of childish manners, and among the symptoms of imbecility there showed itself a strong propensity for windmills. He particularly wished to be tied to one of the arms of the mill when they were going round; he would go any distance to see a windmill, and would sit watching one for days together. His friends removed him to a place where there were no mills, in the hope that this strange propensity would wear away. He collected a number of lucifer-matches and set fire to the house where Dr. Sutherland attended him, with a view that he might escape during the confusion to some imaginary land of windmills; and on another occasion he enticed a child into a wood, and, in attempting to murder it, cut and mangled its limbs with a knife in a horrible manner. How would any sane person have connected this propensity for windmills with the attempts at arson and murder? Yet it turned out that he had taken the resolution to commit these crimes in the hope that he should be removed to some place where there would be a mill! (Report on Lunatics, 'Quart. Rev.' 1844.)

4. *Confession.*—The subsequent conduct of the person: he seeks no *escape*, delivers himself up to justice, and acknowledges the crime laid to his

charge. This is commonly characteristic of homicidal mania; for by the sane criminal every attempt is generally made to conceal all traces of the crime, and he denies it to the last. A case occurred in September 1843 which shows, however, the fallacy of this criterion. A man named *Dadd* murdered his father at Cobham, under circumstances strongly indicative of homicidal mania. He fled to France after the perpetration of the crime, and was subsequently tried, and acquitted on the ground of insanity. (See also another case, 'Ann. d'Hyg.' 1829, vol. 2, p. 392.) On the other hand, it must be remembered that sane persons who destroy the lives of others through revenge or anger, often perpetrate murder openly and do not attempt to deny or conceal the crime, for the simple reason that denial or attempt at concealment would be hopeless. Again, a morbid love of notoriety will often induce sane criminals to attempt assassination under circumstances where the attempt must necessarily be witnessed by hundreds, and there can be no possibility of escape. The attacks made some years since upon the life of the Queen are sufficient to bear out this statement.

5. *Accomplices.*—The sane murderer has generally *accomplices* in vice or crime; the homicidal monomaniac has not. Upon this it may be observed that some of the most atrocious murders committed in modern times—as those perpetrated by *Greenacre*, *Good*, *Courvoisier*, and others—were the acts of solitary persons, who had neither accomplices nor any assignable inducements leading to the commission of the crimes. It is, however, a fact so far in favour of the existence of homicidal insanity, that the *insane* never have accomplices in the acts which they perpetrate. These criteria can hardly be described as medical; they are circumstances upon which a non-professional man may form just as safe a judgment as one who has made insanity a special study.

6. *Delusion in the act.*—The presence of *delusion* has been said to characterize an act of homicidal monomania, while premeditation, precaution, and concealment have been considered the essential features of the act of a sane criminal. With respect to delusion, it has been decided that the mere proof of the existence of this does not excuse the act: if the delusion be *partial* the party accused is still responsible; and if the crime were committed for an imaginary injury he would be held equally responsible. (See *ante*, p. 1103.) Much stress was formerly laid upon the *delusion being connected with the act* in cases of alleged insanity; but it must be remembered that, except by the confessions of insane persons during convalescence, it is not easy for a *sane mind* to connect the most simple acts of a lunatic with the delusion under which he labours. Every act of homicide perpetrated by a really insane person is doubtless connected with some delusion with which he is affected; but it by no means follows that one who is sane should always be able to make out this connection, and it would be therefore unjust to rest the responsibility of an accused person upon an accidental discovery of this kind. Cases elsewhere related show how difficult it is to connect the delusions of the insane with their acts (pp. 1025, 1035, and 1106). Lord Erskine's doctrine in *Hadfield's* case, that, in order to render a person irresponsible, the act should be traced to the delusion, is therefore, medically speaking, untenable. The connection of a delusion with an act, when it can be really traced, may serve to exculpate an accused party, but the non-establishment of this connection proves nothing.

It may be further observed that premeditation, precaution, concealment, and flight are met with in crimes committed by both sane and insane criminals, although these acts are certainly strong characteristics of sanity. It should be a question for a jury whether, when they are proved to have existed in any criminal act, there might not have been such a power of self-control in the person, although in some degree insane, as to justify the application of punishment. It is not the presence of a slight degree of mental aberration which necessarily indicates a loss of power of controlling actions. Are such persons less beyond the influence of example than one half of the sane criminals who are punished?

7. *A number of murders perpetrated at once.*—In the acts of sane criminals one person, or at the most two, may be destroyed; but, in cases of homicidal mania, it is not unusual to find a wife and several children killed by the husband, or four or five children at once destroyed by the wife. A repetition of these atrocities is as common among those who are really insane as it is unusual among the sane. No motive but that which is based on some insane delusion could be suggested for such a series of murders. Thus, four infants may be found murdered by a mother, who admits the act but endeavours to account for it by asserting that she wished to convert them into angels, or to save them from destitution or exposure to worldly temptations.

Summary.—The foregoing considerations lead to the inference that there are *no certain legal or medical tests* whereby homicidal mania can be demonstrated to exist. Each case must be determined by the circumstances attending it: but the true test for irresponsibility in all ambiguous cases appears to be, whether the person, at the time of the commission of the crime, had or had not a *sufficient power of control to govern his actions*; or, in other words, whether he knew the act was wrong, and could avoid the perpetration of it. This involves the consideration, not only whether insanity existed in the accused, but whether it had reached a degree to destroy, not a consciousness of the act, but volition—the will to do or not to do it. If from circumstances it can be inferred that an accused person had this power, whether his case falls within the above rules or not, he should be made responsible and rendered liable to punishment. If, however, he was led to the perpetration of the act by an *insane* impulse, or, in other words, by an impulse which his mental condition did not allow him to control (lésion de volonté, Esquirol), he is entitled to an acquittal as an irresponsible agent. The power of controlling an act appears to me to imply the existence of such a state of sanity as to render the party responsible: and when there is this want of control, it may be fairly concluded that the person is irresponsible. (*Reg.* v. *Brixey*, C. C. C. May 1845, p. 1109.) A test somewhat similar to this is constantly applied by juries, under the direction of our judges, to distinguish murder from manslaughter; and it is quite certain that sanity and homicidal mania are not more nicely blended than those shades of guilt whereby manslaughter passes into murder. The manner and circumstances under which a crime is committed will often allow a fair inference to be drawn as to how far a power of self-control existed or was exercised. A man in a violent fit of mania or delirium rushes with a drawn sword into an open street, and stabs the first person whom he meets; another, worn out by poverty and destitution, destroys his wife and children to prevent them from starving, and then probably attempts to murder himself:—these are cases in which there is a fair ground to entertain a plea of irresponsibility. But when we find a man like *M'Naughten*, who shot Mr. Drummond by mistake for another person, lurking for many days together in a particular locality, having about him a loaded weapon,—watching a particular person who frequents that locality,—not facing the individual and shooting him, but coolly waiting until he has an opportunity of discharging the weapon unobserved by his victim or others,—the circumstances appear to show such a perfect adaptation of means to ends, and such a power of controlling actions, that one is quite at a loss to understand why a plea of irresponsibility should have been received in such a case. (See *Reg.* v. *M'Naughten*, page 1112.) The acquittal was the more remarkable because there was no proof of general insanity, and the crime was committed for a supposed injury. According to the rules laid down by the fifteen judges, from questions submitted to them in connection with this case, this man should certainly have been convicted. These acquittals on the ground of insanity, contrary to public opinion, are often erroneously ascribed to the crotchets of medical experts. They are, I believe, more commonly due to the powerful and impassioned addresses of counsel, who in civil as well as in criminal cases simply fight for victory wholly irrespective of any abstract ideas of justice. Medical opinions are brought forward or suppressed in order to complete a sensational picture, which is intended to show either that a lunatic is perfectly sane, or that a sane man who has committed a deliberate act of murder is beyond any reasonable doubt insane. The last words of the last eloquent speaker have a far greater influence with the jury than the opinions of 'mad doctors' in the witness-box. These admit of being misrepresented and turned into ridicule without any power of reply on the part of those who gave them.

Test of responsibility.—The test of responsibility above suggested is more or less advocated by Esquirol, Marc, Ray, Pagan, Jamieson, and other writers on the medical jurisprudence of insanity. (Esquirol, 'Maladies Mentales,' vol. 2, p. 842.) M. Marc adopts throughout the opinions of Esquirol. ('De la Folie,' vol. 2, p. 71.) Dr. Ray, an intelligent American writer, considers that all forms of homicidal monomania are characterized by an '*irresistible* motiveless impulse to destroy life.' ('Med. Jur. of Insanity,' p. 268.) Dr. Pagan observes: 'The very loss of the *control over our actions* which insanity implies is that which renders the acts which are committed during its continuance undeserving of punishment.' ('Med. Jur. of Insanity,' p. 211.) The test should be, according to Dr. Jamieson, 'Had the lunatic at the time of committing the deed a knowledge that it was criminal, and *such a control* over his actions as ought, if exerted, to have hindered him from committing it?' ('Med. Gaz.' vol. 46, p. 827.) Was his mind so disordered that he had lost that power of control which is possessed by a person in a sane state?—or, as Mr. Stephen puts it in popular language,—Was it his act? Could he help it? Did he know it was wrong? ('Crim. Law,' p. 91.) Thus then it would appear, from the concurrent views of medico-legal writers and of experienced practical observers of the habits and conduct of the insane, that we have here a criterion whereby the responsibility or irresponsibility of an accused person may be fairly tested: and although there may be some difficulty in determining how far the person did or did not possess a control over his actions—whether the impulse was or was not *insane* and irresistible (impuissance de la volonté); yet it must be borne in mind that the same objection applies with equal force, not only to the present legal test (the existence or nonexistence of a *sane consciousness of right or wrong* under which persons are yearly acquitted or executed), but to every test or rule, medical or legal, that has hitherto been proposed either by physician or jurist. There is as great if not greater difficulty in distinguishing sane from insane consciousness of right and wrong, as in distinguishing a sane from an insane impulse in the perpetration of murder.

It is well known that persons seized with a desire to kill have been able, in some instances, to exercise a certain degree of control over their feelings, and have thus spared the lives of their intended victims, and saved themselves from the imputation of a heinous crime. Esquirol has recorded several instances of this kind. ('Maladies Mentales,' vol. 2, p. 807.) On other occasions the controlling power appears to be lost. The case of *Reg.* v. *Brixey* was tried at the Central Criminal Court in June 1845. The prisoner, a quiet inoffensive girl, a maidservant in a respectable family, was charged with the murder of an infant. She had laboured under disordered menstruation, and, a short time before the occurrence, had shown some violence of temper about trivial domestic matters. This was all the evidence of her alleged (intellectual) insanity,—if we except that which was furnished by the *act* of murder. She procured a knife from the kitchen on some slight pretence, and while the nurse was out of the room cut the throat of her master's infant child; she then went downstairs and told her master what she had done. She was perfectly *conscious* of the act she had committed; she treated it as a crime, and showed much anxiety to know whether she should be hanged or transported. There was not the slightest evidence that at the time of the act, or at any time previous, she had laboured under any delusion or intellectual aberration. The prisoner was acquitted on the ground of insanity probably arising from obstructed menstruation. ('Med. Gaz.' vol. 36, pp. 166, 247.) In trying this case by the medical rules laid down for detecting homicidal monomania (*ante*, p. 1106), we shall see that it falls under the 3rd, 4th, and 5th only: *i. e.* absence of motive,—no attempt to escape,—no accomplices. Admitting the probability of a connection existing between suppressed menstruation and insanity in the abstract, there was no proof of the existence of intellectual insanity in the case of this girl,—yet she was acquitted! The existence of legal insanity in this case was a pure fiction based on the *act* committed, and on the *mode* in which it was committed. In his defence of *Brixey*, the late Mr. Clarkson uttered a plain medical and legal truth, in stating that '*no general rules can be applied to cases of this sort*: each case must be decided by the peculiar facts which accompany it.' Notwithstanding the precedent to the contrary furnished by this and other cases of a similar kind (*Reg.* v. *Stowell*, 'Med. Gaz.' vol. 47, p. 569), a Court of Law will commonly look for some clear and distinct proof of mental delusion or *intellectual* aberration existing previously to or at the time of the perpetration of the crime. If there be no proof of delusion, or of failure of intellect on the part of the accused, the plea of impulsive homicidal insanity may still be rejected. In *Reg.* v. *Burton* (Huntingdon Summer Assizes, 1848) the prisoner was indicted for the murder of his wife by cutting her throat. It appeared that he had no motive for killing her,—that he had been previously unwell, and restless at night,—that he did not attempt to conceal or deny the commission of the crime, and that he expressed no sorrow or remorse for it when perpetrated. The medical witness attributed the act to a sudden homicidal impulse: the prisoner's reason was not affected, and he had not laboured under delusions. This appears to have been a proper view of the case. The learned judge dissented from the medical opinion, because the excuse of an irresistible impulse coexisting with the full (?) possession of reason would justify any crime whatever. The facts rendered it probable that there was not a *full* possession of reason in this case; there was some evidence of bodily disease which may have affected the brain, as in the case quoted by Mr. Stephen (p. 1101). No rational being would commit an act of this kind under the circumstances mentioned. As in other cases, there may have been delusions springing up in the mind suddenly, and not revealed by the previous conduct or conversation of the accused. There appears to have been no stronger legal reason for convicting this prisoner than for convicting *Brixey*. He was nevertheless found guilty, while *Brixey* was acquitted.

In *Reg.* v. *Greensmith* (Midland Circuit, July 1837), the prisoner was charged with the murder of four of his young children. The facts were partly brought out in evidence, and partly by his own confession. He was a person of industrious habits and an affectionate father; but having fallen into distressed circumstances, he destroyed his children by strangling them, in order, as he said, that they might not be turned into the streets. The idea only came to him on the night of his perpetrating the crime. After he had strangled two of his children in bed, he went downstairs, where he remained some time; but thinking that he might as well suffer for all as for two, he returned to the bedroom, and destroyed the two whom he had left alive. He shook hands with them before he strangled them. He left the house and went to a neighbour's, but said nothing of the murder until he was apprehended the next day and taken before the Coroner, when he made a full confession. Not one of the witnesses had ever observed the slightest indication of insanity about him. He made no defence, but several medical practitioners came forward to depose that he was insane. The surgeon of the gaol said that the man was feverish, complained of headache, and had been subject to disturbed sleep and sudden starts since the death of his wife a short time before. He spoke of the crime he had committed without the slightest excitement, and the witness said he had heard enough of the evidence to satisfy him that the prisoner could not have committed such a crime as this and be in a sane state of mind. Dr. Blake, physician to the Nottingham Lunatic Asylum, said he was satisfied that the prisoner laboured under a delusion of mind. The prisoner's grandmother and sister had been under his care, the latter for entertaining a homicidal delusion—namely, that of destroying herself and her children. The judge declined receiving this evidence; and under his direction the prisoner was found guilty, and sentence of death was passed upon him. By the active interference of Dr. Blake and others, he was subsequently respited on the ground of insanity. (See 'Med. Chir. Rev.' vol. 28, p. 84.)

Among other cases which may be mentioned are those of *Reg.* v. *Frost* (Norwich Summer Ass. 1844), *Reg.* v. *Dickenson* (C. C. C., March 1844), and of *Nicholas Steinberg*, who in September 1834 cut the throats of his wife and four children, and then destroyed himself; of *Lucas*, who destroyed his three children in March 1842, and *Giles*, who cut the throats of two of his infant children at Hoxton, in January 1843. In these instances the acts of murder were accompanied by suicide. In the case of *Mrs. Brough* (Guildford Summer Ass. 1854), it was proved that the accused destroyed six of her children by cutting their throats, and then attempted to destroy herself. She was acquitted on the ground of insanity, although there was no proof of mental derangement. These cases may be regarded as presenting fearful examples of that state which has been called homicidal mania, in which there were no previous symptoms of *intellectual aberration* amounting to *insanity* in the common meaning of the term, or of any irregularity of conduct on the part of the homicides to justify the least interference with their civil liberty. A uniform feature of such cases is, that the murderous act is directed against those who are most closely connected with the homicides in blood, and to whom they are attached by the tenderest ties.

It appears to me that such crimes as these cannot be fairly or reasonably regarded as the act of *sane* and responsible persons; and even those who deny the existence of such a form of insanity as *homicidal monomania*, are in general compelled to admit that these dreadful motiveless murders are really the acts of insane and irresponsible agents. In reference to the case of *Brixey* (*supra*), if this woman was not labouring under homicidal mania, or an uncontrollable impulse to murder, it is clear from the result that her mental condition at the time of perpetrating the murder was such as to justify her acquittal on the ground of insanity; and medical jurists do not ask for more than this, although the means by which they seek to obtain acquittals in such cases may appear objectionable and unsuited to legal dicta. To assert that there was an unconsciousness of the nature or criminality of the act in this case would be conflicting with all the facts proved; and to contend that the consciousness of right and wrong, if it existed, was itself of an insane kind, would be a mere *ex-post-facto* assumption. The occasional existence of a state of homicidal mania appears to me to be fairly established by this case, for there was not the slightest evidence of previous *intellectual* aberration or of insane conduct, if we except the motiveless character of the act perpetrated and the mode of perpetrating it. The acquittal produced no shock to public feeling, like certain acquittals of a really doubtful kind. Had not the homicides in some of the instances above mentioned destroyed themselves, it is most probable that they would have been acquitted on the ground of insanity. In the case of *Staninought* an acquittal actually took place: this man, who had attempted suicide, recovered, was tried, acquitted on the ground of insanity, and he afterwards destroyed himself.

Much difference of opinion existed relative to the case of *M'Naughten*, who was tried for the murder of Mr. Drummond (Jan. 7, 1843) and acquitted on the ground of insanity. There is hardly a doubt, that, had the deceased given any personal offence to this individual before the perpetration of the act, he would have been convicted: if the deceased, from feeling annoyed at his following him, had struck him or pushed him away before the pistol was fired, it is most probable that the plea of insanity would not have been received. In the acquittal of this man, it is evident that considerable importance was attached to the non-discovery of a motive; for, had any kind of motive been apparent, it is certain that an alleged 'homicidal climax,' *occurring at the particular moment when the deceased's back was turned*, and after several days' watching on the part of the assailant, would not have been admitted as a sufficient exculpatory plea! If we except the case of *Oxford*, tried for shooting at the Queen, there is perhaps no case on record in English jurisprudence where the facts in support of the plea of insanity were so slight; and when the cases of *Bellingham*, *Lees*, and *Cooper* are considered, it must be evident that there is great uncertainty in the operation of our criminal law. Thus it would be difficult to reconcile, upon *medical* grounds, the conviction of *Francis* with the acquittal of *Oxford*, both of them tried for the same crime (shooting at the Queen) committed under similar circumstances. Either some persons are improperly acquitted on the plea of insanity, or others are unjustly executed. If the punishment of death were abolished, there is no doubt that less would be heard of this plea; but in the mean time it is unfortunate that there is no other way of avoiding capital punishment than by striving to make it appear that a criminal is insane! (See Prichard, p. 399.) It is on this point that medical witnesses seem to me to lose sight of their true position—they too frequently look to results. When the punishment attached to an offence is not capital, it would appear that much stronger evidence is required to establish a plea of insanity than under other circumstances. This will be seen by reference to the case of *The Queen* v. *Grove* (Stafford Lent Assizes, 1842). The evidence of insanity was considerably stronger than that adduced in the case of *M'Naughten*, yet the prisoner was convicted! These two cases, occurring one after the other, display the great uncertainty attendant upon a defence of this kind.

The case of *Reg.* v. *Laurence* (Lewes Lent Ass. 1844) affords a remarkable contrast to that of *M'Naughten*. The prisoner had been arrested by a constable for a petty theft: he was taken to a police-station, where the inspector, who was an utter stranger to him, was at the time engaged in talking to some friends, his back being turned to the prisoner. The man suddenly seized a poker and struck the inspector a violent blow on the skull, from which he speedily died. The prisoner admitted that he struck the blow; that he had no motive for the act; and that he would have struck any one else who had been standing there at the time. He also said he hoped the deceased would die; he was glad he had done it, and he wished to be hanged. The evidence at the trial showed that there was no cause of quarrel between the parties, but that the prisoner appeared to be actuated by some *sudden impulse*, for which not the slightest reason could be assigned. This man was left to a chance defence, for the Court was actually obliged to assign counsel to him. There was no eloquent advocate to make a brilliant speech in his favour; there were no medical experts, profoundly versed in the subject of insanity, to contend for the existence of a 'homicidal climax,' or of impulsive homicidal mania; but there was simply a formal plea of insanity, resting upon the fact of the deceased being a stranger to him, and of there being, consequently, no motive for the act of murder. The jury negatived this plea, and the prisoner was convicted and executed! The differences between the case and that of *M'Naughten* were, that there was in *Laurence* less evidence of deliberation, with stronger evidence of sudden impulse; but there was not sufficient interest about the deceased, the prisoner, or his crime, to attract any great public attention!

This case had not long occurred, when another of a similar kind was the subject of a trial at the Central Criminal Court (*Reg.* v. *Hon. Ross Touchett*, October 1844.) The prisoner, a young man, entered a shooting-gallery in Holborn, took up a pistol and deliberately fired at the proprietor of the gallery while his back was turned, thereby inflicting a wound which ultimately led to his death after the long period of eleven months. The prisoner was tried for shooting with intent to murder; the defence was insanity, founded on the absence of motive for the act, and on the presumption of hereditary taint. After having fired the pistol the prisoner said he did it on purpose, for he wished to be hanged. There was no evidence of *intellectual* aberration: his landlady said he was a very regular and quiet person, but he had complained of a sensation of boiling at the top of his head! Dr. Monro considered that at the time of the act the prisoner was labouring under mental derangement. He admitted to him that he had no knowledge of Mr. Smith (the person whom he shot), but that he wished to be hanged, and had been brooding over suicide for some years. The prisoner referred to the case of *Laurence*, who had killed a man at Brighton (*supra*), and said that he wished to do something of the same kind in order to get himself hanged. The prisoner was well defended, and he was acquitted on the ground of insanity. What distinction can possibly be made by physician or jurist between these two cases,—or how is it possible to lay down rules for the future guidance of medical witnesses under such capricious verdicts? The acquittal of *Touchett* may have been perfectly right, but then the conviction and execution of *Laurence* was a public wrong!

In homicidal mania very vague meanings have been sometimes assigned to the term *delusion.* In *Reg.* v. *Burton* (Maidstone Lent Assizes, 1863), the prisoner, a youth of 18, was indicted for the murder of a boy at Chatham. There was no motive, but it was argued by his counsel in defence, that he laboured at the time under a delusion—the delusion being a desire to be hanged. Mr. Joy, the surgeon of the prison, stated that he had had frequent opportunities of examining the prisoner while in gaol, and in his opinion he was perfectly sane; so far as witness could judge, he was under no delusion. The jury returned a verdict of 'guilty'. If the youth had believed that he had been already hanged for murder, this might have been considered a delusion; but a desire to be hanged or to die from any violent cause cannot be so regarded. The remarks of the learned judge (the late Mr. Justice Wightman) upon this kind of defence contains all that is necessary to show its fallacy. In passing sentence upon the prisoner he said: 'It is stated that you laboured under a morbid desire to die by the hands of justice, and that for this purpose you committed the murder. This morbid desire to part with your own life can hardly be called a delusion; and, indeed, the consciousness on your part that you could effect your purpose by designedly depriving another of life (for which you would have to suffer, as you knew, the punishment due to the greatest of crimes) shows that you were perfectly able to understand the nature and consequences of the act which you were committing, and that you knew it was a crime for which by law the penalty was capital. This was, in truth, a further, and I may say a deeper, aggravation of the crime; for you designedly intended to compass your own death by the murder of another.'

In the case of *Bryce* (High Court of Justiciary, Edinburgh, May 1864) the defence of insanity was rejected by the jury. The medical grounds on which it rested were that the prisoner was a person of low mental organization, and that at the time of the murder he acted under a delusion that the person whom he murdered had called him a 'drunken blackguard.' But in answer to this it was stated that it was precisely persons of low mental organization who committed murder, and who required to be restrained by the fear of punishment; and as to the second point, the medical witnesses admitted that if it were true the deceased had called the prisoner a 'drunken blackguard' there would be no delusion in the matter. ('Ed. Monthly Journal,' July 1864, p. 76.)

In *Reg.* v. *Adams* (Maidstone Summer Assizes, 1856) the prisoner was indicted for cutting and wounding her infant child, aged four months. It was proved that she was a quiet harmless woman: there was no motive for the act; and, when asked why she had done it, she said she had had an intention to do it for a fortnight, and that for three or four nights she had been unable to sleep in consequence of thinking about it: and at last she had done it. She was out of health at the time, and the medical evidence was to the effect that she was probably suffering from some morbid action of the brain when she committed the act. There was no evidence of *intellectual* insanity. Erle, J., considered that the prisoner was not criminally responsible on account of the state of her mind, and a verdict of 'not guilty' was returned on the ground of insanity. The case of *Dedea Redanies* (Maidstone Winter Assizes, 1856) called forth this plea, apparently because there was no other point on which a defence could possibly turn. The prisoner inveigled two girls from their home under false pretences, and murdered them by stabbing them deliberately, one after the other, on the highroad. He admitted that he had destroyed them, and no motive could be suggested but a morbid and unfounded feeling of jealousy. The acts and correspondence of this man before and subsequently to his conviction were such as to convey an idea that he was in some degree insane; still there was no evidence that his insanity had reached a degree to justify his acquittal on this ground, and his conviction and punishment might fairly operate by preventing others labouring under like morbid feelings from indulging in a propensity to destroy life. The case of *Reg.* v. *Buranelli* (Cent. Crim. Court, April 1855), also a charge of deliberate assassination, was marked by a great difference of opinion among the medical experts. Dr. Conolly considered the prisoner's mind to be in an unsound state, while Drs. Mayo and Sutherland deposed that there was no unsoundness, and that the man was a hypochondriac rather than a lunatic. The crime was committed under circumstances which in my opinion fully warranted a conviction for murder. Peculiarities of conduct or conversation are not of themselves sufficient to justify an acquittal on the ground of insanity. Even admitting that the acts adduced in evidence were not those of a person of reasonable mind, this, as it has been elsewhere stated, is not legally sufficient to justify an acquittal. The insanity must have reached such a degree as to overpower the mind or will, and when this is not proved no case for exculpation is made out.

Some doubt has existed whether a medical witness, on a trial in which a plea of insanity is raised, could be asked his opinion, from the evidence respecting the state of a prisoner's mind at the time of the commission of the alleged crime,—whether the accused was conscious at the time of doing the act that he was doing something contrary to law, or whether he was then labouring under any and what delusion. It has been decided, by fourteen judges out of fifteen, that facts tending to lead to a strong suspicion of insanity must be proved and admitted before the opinion of a medical witness can be received on these points. (See 'Med. Gaz.,' vol. 46, p. 240.)

In giving an opinion of the mental condition of an accused person, it is no part of the province of a witness to modify that opinion according to the *punishment* which may follow if the plea be rejected, but simply according to the medical *facts* of the case. The Legislature only is responsible for the punishment adjudged to crimes. Dr. Mayo has justly observed, that a medical witness is summoned to a Court of Justice in order to enable the judge and jury to arrive at certain practical conclusions. The question proposed to him involves a simple fact and not its consequences; and if the latter consideration be entertained by him, it will be liable to bias his evidence on the fact, which is his legitimate topic. The definition of insanity becomes very expansive when its expansion may become protective to a criminal with whom we may happen to sympathize. The question whether the accused is a responsible agent is of a judicial nature: our evidence should be confined to the question whether the accused is *insane* in a certain sense or meaning in which it is understood and defined by law. ('Medical Testimony and Evidence in Cases of Lunacy,' 1854, p. 9.) A medical witness in these cases generally moulds his evidence to a foregone conclusion on the criminal responsibility of the accused, and he thus lays himself open to a remark from the judge that he must not encroach on the functions of the jury. It is certainly a great evil that, under the present mode of laying this question before a jury, the law operates unequally. One case becomes a subject of prominent public interest, and every exertion is made to construe the most trivial eccentricities of character into proofs of insanity, and to magnify the effects of a hereditary tendency, owing to a maternal grandmother's sister or some remote relative having been confined as a lunatic:—an acquittal follows. Another case may excite no interest,—it is left to itself: the accused is convicted, and either executed or otherwise punished, although the evidence of insanity, had it been as carefully sought for and brought out, would have been stronger in this than in the former instance.

That this kind of defence has been carried too far will be apparent from an observation of the late Baron Gurney, in the case of *Rex* v. *Reynolds*, where this learned judge said that 'the defence of insanity had lately grown to a fearful height, and the security of the public required that it should be closely watched.' So also the late Mr. Justice Coltman, in the case of *Reg.* v. *Weyman*, remarked that 'the defence of insanity was one which was to be watched with considerable strictness, because it was not any slight deviation from the conduct that a rational man would pursue under a given state of circumstances which would support such a line of defence. In more recent cases it has been resorted to simply because apparently every other defence was shut out by the evidence.' Probably no case in modern times has produced greater excitement in the public mind, or so strongly directed attention to the defence of insanity in trials for murder, as that of *George Victor Townley*, who was charged with the murder of a young lady to whom he was engaged to be married (*Reg.* v. *Townley*, Derby Winter Assizes, 1863). In this case there was a clear and distinct motive; there was a full consciousness of the nature of the act and of its penal consequences, as well as an absence of any delusion or of anything indicative of intellectual insanity in the conduct of the prisoner up to within a short time of the act, or in the numerous letters which he wrote. The prisoner had entered into an engagement with the deceased (Miss Goodwin). Shortly before the murder she had written to him requesting to be released from her engagement; she candidly told him that she had formed an attachment to another man. In his correspondence with her he requested a last interview, to hear (as he said) her determination from her own lips. The prisoner went to her house on the 21st August 1863, induced the deceased to take a walk with him; and in about an hour she was found bleeding from severe wounds in the throat, from the effects of which she soon died. Townley made no attempt to escape: he admitted that he had stabbed her, and assisted in carrying her dead body to Wigwell Hall, where she resided.

At the trial there was no answer to the charge of murder, except that the prisoner was insane when he perpetrated the act; that he was maddened partly by the refusal of the deceased to marry him, and partly by the knowledge that she was engaged and would probably be married to another man. Some evidence was produced to show that the prisoner was impulsive and excitable at times, and had been reserved in his manners; but no one of his relatives had ever treated him or regarded him as insane, and, until this murder was perpetrated, no one had ever suggested that he had done any act or uttered any expression indicative of insanity. There was some evidence of the existence of insanity in the family of the prisoner's grandmother. The defence was thus chiefly thrown upon the medical evidence. Dr. F. Winslow, on the part of the relatives, examined the prisoner in gaol three months after the perpetration of the crime, and then considered the case of Townley to be one of 'general derangement,' and that he had not a sane opinion on any moral point. The prisoner expressed no regret or remorse for what he had done,—he denied that he had committed any crime—said deceased was his property, and that he killed her to recover and repossess himself of property which had been stolen from him. He knew that killing a person was contrary to law and wrong in this sense; and, from his saying he should be hanged, he must have known that he had done wrong. Dr. Gisborne, a surgeon of the gaol in which the prisoner was confined, gave similar evidence, and stated that when admitted in August Townley was in the same condition as when he was examined by Dr. Winslow in November.

In reference to this defence of insanity, the following remarks were made at the time by the learned judge :—

Baron Martin.—'I have not sat here to try this case without well considering what question I should leave to the jury, and I will now read to you what I have written down, and what I propose to leave to the jury. I shall tell them that although there might have been disease of the mind to some extent, yet if the prisoner knew that the act he was committing would probably cause death, and that the doing of it would subject him to legal punishment, there was criminal responsibility.'

Counsel for the Prisoner.—'Many men have been acquitted with approval who must have been convicted under such a direction.'

Baron Martin.—'I have drawn that from a summing-up of Justice Le Blanc, which has been much approved of, and from a decision of Lord Denman and another of Lord Lyndhurst, and I believe it to be a correct statement of the law. I have put aside from my consideration the ruling of the judge who tried *Bellingham*, because that ruling has been objected to.'

The charge of the learned judge embraced nearly all the contested points involved in the medical theories of homicidal or impulsive insanity, and it will serve to show that the evidence for the defence utterly failed to prove the existence of insanity at the time of the act, upon any reasonable or even probable grounds consistent with the proper administration of the law and the due protection of society. Baron Martin said:—' So far as the act of murder was concerned, it was the clearest case he had ever had the misfortune to try. It was plain that the prisoner had suffered (from his rejection by the deceased) as much as probably any man ever had suffered; but it was equally clear that he did not appear to be insane in the eyes of the landlady of the Bull's Head, or in those of Mr. Harris. The prisoner soon afterwards went to the Hall, and remained in the company of the young lady from half-past six to nearly nine o'clock, when the deed was committed. It was probable that he implored her to renew the engagement, and perhaps reproached her with her conduct towards him: he then inflicted upon her the wounds which had caused her death. That was murder subject only to the question of insanity. No one could doubt that the prisoner knew what he was doing, and that his act would cause death. Unless he was insane therefore, under such circumstances he was guilty of murder. No word was more vague than insanity. Probably there was not one of the jury but was acquainted with some man who was in the habit of doing extraordinary things, and of whom people said, "Why, that man must be insane." Two years ago an investigation took place into the condition of mind of a gentleman from the eastern parts of the country. There was a long inquiry, which excited great public interest, and there was a great divergence of opinion among medical men. Great eccentricity of conduct on the part of that person was shown, yet there was nothing to relieve him from criminal responsibility. Probably he was not the wisest of men, yet he was of sufficient intellect to take care of himself and avoid doing injury to others. There was a somewhat similar case at the last Gloucester Assizes, in which a young lady was under the impression that a number of ladies had formed an unfounded dislike to her. In all probability she was labouring under a delusion with respect to these persons, yet she was as subject to the criminal law as any one in that Court. *What the law meant by an insane man was a man who acted under a delusion, and supposed a state of things to exist which did not exist, and acted thereupon.* A man who did so was under a delusion, and a person so labouring was insane. In one species of insanity the patient lost his mind altogether, and had nothing but instinct left; such a person would destroy his fellow-creatures, as a tiger would his prey, by instinct only. A man in this state had no mind at all, and therefore was not criminally responsible. The law, however, went further than that. If a man labouring under a delusion did something of which he did not know the real character, something of the effect and consequences of which he was ignorant, he was not responsible. An ordinary instance of such a delusion was where a man fancied himself a king and treated all around him as his subjects. If such a man were to kill another under the supposition that he was exercising his prerogative as a king, and that he was called upon to execute the other as a criminal, he would not be responsible. The result was, that if the jury believed that at the time the act was committed the prisoner was labouring under a delusion, and believed that he was doing an act which was not wrong, or of which he did not know the consequences, he would be excused. If, on the other hand, he well knew that his act would take away life, that that act was contrary to the law of God and punishable by the law of the land, he was guilty of murder. That was the real question they had to try. He had already stated his opinion that the law upon the subject had been best laid down by Justice Le Blanc, as able a judge as ever sat on the Bench. Justice Le Blanc, in the case alluded to, observed to the jury that it was for them to determine whether the prisoner when he committed the offence with which he stood charged was incapable of distinguishing right from wrong, or under the influence of any delusion which rendered his mind at the moment insensible of the nature of the act he was about to commit—since in that case he would not be legally responsible for his conduct. On the other hand, provided they should be of opinion that when he committed the offence he was capable of distinguishing right from wrong, and not under the influence of such a delusion as disabled him from discerning that he was doing a wrong act, he would be amenable to the justice of his country and guilty in the eye of the law. That in his (Baron Martin's) opinion was a correct statement of the law. He should not allude to Bellingham's case because many were of opinion that that was an unsatisfactory trial. In a more recent case the late Lord Lyndhurst told the jury that they must be satisfied, before they could acquit the prisoner on the ground of insanity, that he did not know when he committed the act what the effect of it, if fatal, would be. With reference to the crime of murder, the question was, did he know that he was committing an offence against the laws of God and nature? In Oxford's case Lord Denman said: "Something has been said about the power to contract and to make a will; but I think that these things do not supply any test. The question is, whether the prisoner was labouring under that species of insanity which satisfies you that he was quite unaware of the nature, character, and consequences of the act which he was committing; or, in other words, whether he was under the influence of a diseased mind, and was really unconscious at the time he was committing the act that it was a crime." The jury must judge of the act by the prisoner's statements, and by what he did at the time. Unless they were satisfied—and it was for the prisoner to satisfy them—that he did not know the consequences of his act, or that it was against the law of God and man and would subject him to punishment, he was guilty of murder. The prisoner's letters appeared to be the most sensible letters he had ever read. The reason the prisoner gave for his act was, "She should not have proved false to me." Now, if his real motive was that he conceived himself to have been illused, and if he committed the act either from jealousy of the man who was preferred to him, or from a desire of revenge upon her, that would be murder. These were the very passions which the law required men to control, and if the deed was done under the influence of these passions there was no doubt that it was murder. The prisoner's expression that he should be hanged for it indicated that he knew the consequences of his act. Another reason he gave for what he had done was, "The woman who deceives me must die!" If a young lady promised to marry a man and then changed her mind, it might be truly said that she deceived him; but what would be the consequences to society if men were to say that any woman who treated them in that way should die, and were to carry out these views by cutting her throat? The prisoner claimed to exercise the same power over a wife as he could lawfully exercise over a chattel, but that was not a delusion nor even like a delusion. It was the conclusion of a man who had arrived at results different from those generally arrived at, and contrary to the laws of God and man, but it was no delusion. Evidence indeed had been given of an actual delusion in the prisoner's mind in supposing that there was a conspiracy against him. That was an apt and common instance of delusion. There was also evidence of insanity in the maternal line, and it was true that insanity was hereditary and did descend in families. The object of this was to show that it was possible and not unlikely that a hereditary taint might exist in the prisoner. All the evidence, however, failed to prove the existence of any delusion in the prisoner's mind which could explain this act. None of his family conceived him to be mad. It was clear that such an idea had not entered into their minds, or they would not have recommended him to go and see Miss Goodwin. They treated him as sane from beginning to end, and as a proper person to contract matrimony and reengage the affections of this young woman. The account of his state of mind upon receiving her letters was most probably correct. Most men would probably suffer in the same way under similar circumstances. It had been said by one of the witnesses that the prisoner did not know the difference between good and evil. If that was a test of insanity many men were tried who did not know that difference—in truth it was no test at all. The idea of a conspiracy was a delusion, but the mere setting himself up against the law of God and man was not a delusion at all. The question for the jury was —Was the prisoner insane, and did he do the act under a delusion, believing it to be other than it was? If he knew what he was doing, and that it was likely to cause death and was contrary to the law of God and man, and that the law directed that persons who did such acts should be punished, he was guilty of murder.' The jury returned a verdict of *Guilty* of wilful murder.

Taking into consideration all the circumstances of this case, it is in my opinion impossible to regard the act in any other light than as one of murder through jealousy. This was the general view of the public, who were kept for some time in a state of excitement in reference to this criminal. Three Commissioners in Lunacy, Mr. Campbell, Mr. Wilkes, and Mr. Foster, in consequence of a recommendation from the judge, were appointed by Secretary Sir G. Grey to see and examine the prisoner and report to him on his *then* mental condition—the inquiry at the trial having been confined to the state of his mind on the day of the murder. They reported as the result of their interview with him, that they could not consider him to be of sound mind, but applying the law as laid down by the judge he was justly convicted. This so far coincided with the view of the learned judge that the conviction was right. Under the 3rd and 4th Vict. c. 54. s. 1 (since repealed by the 27th and 28th Vict. c. 29), a certificate was drawn up by two justices and two medical men to the effect that the prisoner was insane. The capital sentence was respited but not commuted, and under the order of the Secretary of State the prisoner was removed to Bethlehem Hospital. As this proceeding was not considered to be satisfactory, a second commission was issued by the Government to make further inquiry into the state of mind of the prisoner. The commissioners were Dr. Hood, Dr. Bucknill, Dr. Meyer, and Dr. Helps—all men of good experience in reference to insanity. After two lengthened interviews with the prisoner, they came to the conclusion that he was of sound mind. The reasons which they assign in their report are clear and satisfactory, but too long to be quoted in this place. On their unbiassed judgment the sentence of the prisoner was commuted to penal servitude for life. He was removed to a convict prison, where he subsequently committed sucide.

Tested by the rules respecting criminal responsibility assigned by Mr. Fitzjames Stephen, the evidence in this case shows clearly intention, will, and malice (*ante*, page 1109). There was an absence of proof of delusion, and to affirm that the act arose from an irresistible impulse is a mere assumption, without any fact in the previous or subsequent conduct of Townley to give to it support. It may be well inquired of those who adopt the theory of irresponsibility in this case—If this is *insanity*, what is *crime*? If Townley was irresponsible for *an act* thus coolly perpetrated, in which the motive was so clear, no person should hereafter be convicted of murder who stabbed a woman from jealousy, revenge, or mortified pride. There was no doubt that Townley had a consciousness of right and wrong—that he knew the act was illegal and punishable by the law of the land; but his guilt did not rest upon these judicial tests of criminal responsibility. He had this knowledge in common with all sane and some really insane persons. In his case, however, insanity was neither proved nor rendered even probable, while it was disproved by his conduct and all the circumstances connected with the act of murder. It may be wrong to convict all men who come up to this judicial standard, *i. e.* who know right from wrong, because insanity may coexist with such knowledge; but it would be a great fallacy to suppose that, in the absence of any clear proofs of insanity, a man is to be acquitted of crime because he was doing an act which he knew was wrong, and of which he well knew and calculated the legal consequences. One medical defender of Townley, in order to account for the absence of symptoms of insanity, suggested that the duration of the homicidal impulse was short, and did not extend beyond the period of the commission of the act to which it impelled! There would be no difficulty in making out on these principles that every act of murder was the result of impulsive insanity, and that all murderers while stabbing others are morally insane, and therefore, although they may show sanity afterwards, they are irresponsible for their acts. The legal test of a consciousness of right and wrong is much complained of, but in practice it certainly cannot be said to err on the side of harshness or severity; for it is much more common that sane persons should be acquitted on the ground of insanity, than that one who is really insane should be convicted and punished as a sane criminal. But the medical assumption here suggested to extenuate Townley's crime would go far to exculpate every criminal who committed murder.

It cannot be denied that the doctrine of 'irresistible impulse' and the theory of impulsive insanity have been strained in recent times to such a degree as to create in the public mind a justifiable distrust of medical evidence on these occasions. It is obviously easy to convert this into a plea for the extenuation of all kinds of crimes for which motives are not apparent, and thus medical witnesses often expose themselves to severe rebuke. They are certainly not justified in setting up such a defence, unless they are prepared to draw a clear and common-sense distinction between impulses which are 'unresisted' and those which are irresistible. In the case of *Reg.* v. *Allnutt*, the prisoner, a boy aged 12, was convicted of poisoning his grandfather, under circumstances indicative of sane contrivance and deliberation. The medical evidence entirely failed to show that the prisoner was or ever had been insane in a legal sense. The remarks made by the judge who tried the case (Rolfe, B.) are of some medico-legal importance: 'The witnesses called for the defence had described the prisoner as acting from uncontrollable impulse, and they had made other statements, of the value of which it would be for the jury to decide; but he must say that it was his opinion that such evidence ought to be scanned by juries with very great jealousy and suspicion, because it might tend to the justification of every crime that was committed. What was the meaning of not being able to resist an impulse? Every crime was committed under an impulse, and the object of the law was to compel persons to control or resist these impulses. If it was made an excuse for a person who had committed a crime, that he had been goaded to it by some impulse which medical men might choose to say *he* could *not* control, such a doctrine would be fraught with very great danger to society.'

Some medical men think, if they discover anything resembling a delusion in the mind of an accused person, that he is necessarily irresponsible; but the theory of the law as laid down by the judges in *M'Naughten's* case is, that notwithstanding a person labours under a delusion, if he commits an act which he knows to be contrary to law, he is liable to punishment (*ante*, p. 1103). Dr. Mayo observes that the very case which elicited this answer (*Reg.* v. *M'Naughten*) proves that the practice is not in accordance with theory: 'The adequacy of M'Naughten to comprehend the criminal nature of the homicidal act for which he was tried was unquestionable, yet he was acquitted on the plea of insanity, without the smallest reference to the conditions on which alone it is exculpatory, although they had been distinctly set forth as not complied with in the opening speech of the Attorney-General. The prisoner was pronounced to be insane by several medical witnesses, and on this evidence the learned judge stopped the case, and directed an acquittal, without going into the question whether the prisoner was or was not ignorant of the illegal nature of his act. In his address to the jury, he used the ambiguous expression of a knowledge of "right and wrong" (not "legal and illegal") as absent in M'Naughten's mind.' ('Medical Testimony,' p. 86.) The terms 'right and wrong,' thus used, are certainly vague and undefined. If that which is legal is right, and that which is illegal is wrong, it would be only proper to discard the words, 'of a knowledge of right and wrong,' and place the question before the jury in accordance with the answers given by the judges in *M'Naughten's* case—namely, whether the prisoner knew at the time of committing the act that it was illegal? The test of responsibility assumed by it is purely theoretical, and such that it cannot be strictly carried into practice. With this admission it appears to me unnecessary to occupy space with metaphysical discussions regarding criminal responsibility: for however defective the rules,—if the *practice* of the law be in any one case in conformity with that which has been advised by writers on the Medical Jurisprudence of Insanity, although it may be adverse to the theory on which it is professedly based, this is all with which we have to concern ourselves:—the principle is admitted. The great defect in the English law is, not that it will not go even to the full extent of exculpating a person who has committed a crime with a full knowledge of its illegality, and under what is called an 'uncontrollable impulse,' or an impulse which his reason was not sufficient to control, but the *uncertainty of its application.* The cases referred to show that an acquittal on the plea of insanity is on some occasions a mere matter of accident.

The following cases may be consulted with interest in reference to this subject:—*Reg.* v. *Johnstone* ('Med. Gaz.' vol. 37, p. 421); *Reg.* v. *Ovenston* ('Journal of Psychol. Med.' 1848, p. 193); and *Reg.* v. *Brough*, Guildford Summer Assizes, 1854 ('Journal Psychological Medicine,' 1854, p. 609). In the first two the prisoners were acquitted on the ground of insanity; although I quite agree with Dr Mayo in thinking that in *Johnstone's* case there was not the slightest proof of insanity. ('Clinical Facts,' p. 208.) The reader will find other cases in the 'Med. Gaz.' (vol. 43, p. 255); and *Reg.* v. *Clarke*, Norfolk Lent Assizes, 1851; *Reg.* v. *Monkhouse*, Cent. Crim. Court, Dec. 1849; *Reg.* v. *Arnold*, Aylesbury Lent Assizes, 1850; and *Reg.* v. *Butter*, Shrewsbury Summer Assizes, 1853:—in Mayo's 'Clinical Facts,' 1847, p. 193; Croonian Lectures, 'Med. Times and Gaz.' 1853; also 'Medical Testimony,' 1854:—in the Lettsomian Lectures of Dr. F. Winslow, 'Lancet,' June 1853, 'Med. Gaz.' vol. 37, p. 421, and 'Journal of Psychol. Med.' 1848, p. 609:—in essays on 'Unsoundness of Mind in Reference to Responsibility,' by Mr. Knaggs, 1854; by Dr. Bucknill, on 'Unsoundness of Mind in Relation to Criminal Acts,' 1854; and by Mr. F. Stephen on 'The Criminal Responsibility of Madmen' ('Judicial Papers,' vol. 1, p. 67); also his 'Criminal Law of England,' 1853.

CHAPTER 86.

PUERPERAL MANIA—PYROMANIA—KLEPTOMANIA—EROTOMANIA—AIDOIOMANIA—DIPSOMANIA—RESPONSIBILITY OF DRUNKARDS—DELIRIUM TREMENS—SOMNAMBULISM—THE DEAF AND DUMB—FEIGNED DEAFNESS AND DUMBNESS.

PUERPERAL MANIA.

MANIA may present itself in other forms than those hitherto considered. Women who have been recently delivered are liable to sudden attacks, in which a disposition to murder their offspring is the most marked symptom. This has been long known and recognized by physicians as 'puerperal mania.' The disorder seldom attacks a woman before the third day,—often not for a fortnight, and in some instances not until several weeks after delivery. Out of ninety-two cases, Dr. Simpson observed that the attack occurred in twenty-one between the fifth and the fifteenth day. ('Med. Times and Gaz.' Sept. 1, 1860, p. 201.) The most frequent period is at or about the commencement of lactation, and between that and the cessation of the uterine discharges (lochia). According to Esquirol, it is generally preceded or attended by a suppression of the lochia and milk. The late Dr. Ashwell remarked that undue lactation might give rise to an attack of mania, under which the murder of the offspring might be perpetrated. ('Diseases of Women,' p. 732. See the case of *Reg.* v. *Lacey*, Nottingham Summer Assizes, 1858.) It may also come on after forced or voluntary weaning. The *symptoms* do not differ from those of mania generally, but it may assume any of the other forms of insanity; and, in one half of the cases, it may be traced to hereditary tendency.

According to Dr. Burrows, there is delirium, with a childish disposition for harmless mischief. The woman is gay and joyous, laughing, singing, loquacious, inclined to talk obscenely, and careless of everything around. She imagines that her food is poisoned; she may conceal the suspicion, and merely avoid taking what is offered to her. She can recognize persons and things; and can, though perhaps she will not, answer direct questions. Occasionally there is great depression of spirits, with melancholia. These facts are of some importance in reference to cases of alleged child-murder. This state may last a few hours, or for some days or weeks. The murder of the child is generally either the result of a sudden fit of delirium, or a sudden impulse, with a full knowledge of the wickedness and illegality of the act; so that the legal test of responsibility of a knowledge of right and wrong cannot be applied to such cases, except on the assumption that insanity already exists and taints the consciousness of the individual. Women have been known to request their attendants to remove the child, but have afterwards taken an opportunity to destroy it. Such cases are commonly distinguished from deliberate child-murder by there being no motive, no attempt at concealment, nor any denial of the crime on detection. Several trials involving a question of puerperal mania have been decided, generally in favour of the insanity, within the last few years. Among these is that of *Reg.* v. *Ryder* (C.C.C. March 1856). There was an entire absence of motive in this as in most other cases of a similar kind. The mother was much attached to the child, and had been singing and playing with it on the morning of its death. She destroyed the child by placing it in a pan of water in her bedroom. The medical evidence proved that she had been delivered about a fortnight previously—that she had had an attack of fever, and that she had probably committed this act while in a state of delirium. She was acquitted on the ground of insanity: and Erle, J., remarked that it was evidently a case in which the insanity was only temporary, and the prisoner might be restored to her friends on a representation being made in the proper quarter. In most of these cases it will be found that women are fully aware of the nature of the act, and that it is contrary to the laws of God and man: they even make every effort to resist it, but they are unable to control their actions like sane persons.

Women in the *pregnant* state have been known to perpetrate murder apparently from some sudden perversion of their moral feelings: there has been probably latent intellectual disturbance, but not sufficient to attract the notice of friends. There is a great sympathy between the uterine organs and the brain, which may account for such cases; but I am not aware that irresponsibility on the ground of insanity has been admitted in this country under these circumstances. (See case, 'Ann. d'Hyg.' 1831, vol. 1, p. 374; also 'Ann. d'Hyg.' 1859, vol. 2, p. 334.) For an able analysis of the present state of our knowledge on the subject of Puerperal Insanity, by Dr. Reid, see 'Journal of Psychological Medicine' for 1848, pp. 128, 284.

PYROMANIA.

Propensity to incendiarism.—This is described as a variety of monomania in which there is a morbid disposition of mind leading to impulsive acts of incendiarism without any motive. It is a condition not specially recognized by English jurists or in English courts of justice. We are informed by the advocates of its independent existence, that it proceeds from a sudden impulse, or from delusive reasoning, but most commonly the latter. It has been said to occur in females about the age of puberty, and is supposed to be connected with disordered menstruation. The case of *Jonathan Martin* has been frequently quoted as an instance of pyromania. He had, however, merely a delusion that he was deputed by God to burn down the Cathedral of York, in order to do away with the heresies which he supposed to exist in the Church. There was no doubt of his insanity; he had been already twice confined in an asylum. Nevertheless, as the late Baron Alderson (who was counsel for the prosecution) remarked, the act was perpetrated with much method. It seems that Martin remained behind after the afternoon service, and when left alone he went up into the belfry, cut off about eighty or ninety feet in length of the *prayer-bell rope*, which, being usually rung from below, had been drawn up and coiled up to that length there. With this rope he succeeded in knotting a sort of ladder, and throwing it over the iron gates of the choir, he climbed over by means of the knots. Being in the choir, he struck a light with a flint and his razor, lighted a candle which he had brought, collected the prayer-books, and set fire to the paper, close to the carved work at the archbishop's throne, in two piles. He then cut away a silk curtain, gold fringe, &c., *which he stole*; and getting back by his rope-ladder into the body of the cathedral, he escaped through a window on the north side,—the most unfrequented part. He had provided himself with a pair of pincers, by which he forced the window, and let himself out by his rope-ladder to the ground. A sane criminal could hardly have devised a better method of perpetrating the act, or of escaping after its perpetration. The defence, as in most of these cases, was insanity at the time of perpetrating the act, and not specially Pyromania.

This so-called mania is said to be not uncommon in young persons of both sexes about the age of puberty. Assuming that a morbid impulse of the kind may exist, it should be cautiously received as an exculpatory plea, since otherwise it might be easily converted into a means for withdrawing real criminals from all legal control. I would here especially direct the attention of the reader to an essay on this subject by Professor Casper of Berlin, in which he denies, with great probability, the existence of such a propensity as having any connection with insanity. He believes that incendiarism, perpetrated either with or without motive, is always a criminal act; and unless there is clear evidence of a disordered mind, it should be always punished as a crime. (Denkwürdigkeiten zur 'Med. Stat.' Berlin, 1846, p. 255.) A defence of this kind has been admitted in English law, but only in those instances in which there was strong reason to suspect the existence of intellectual aberration. ('Med. Gaz.' vol. 12, p. 80.) In one case (*Reg.* v. *White*, Wilts Summer Ass. 1846) the prisoner was convicted, on the principle that, although of weak intellect, she had reason enough to know right from wrong. (See 'Ann. d'Hyg.' 1833, vol. 2, p. 357; 1834, vol. 2, p. 94.)

Among several important trials in which a plea of insanity has been urged in defence in cases of arson is that of *James Gibson*, tried before the High Court of Justiciary, Edinburgh, Dec. 23, 1844, and of which a full report will be found in vol. 4 of Brown's 'Reports of Cases before the High Court,' 1845, p. 332. The prisoner was charged with setting fire to certain premises, and the defence chiefly rested upon the allegation, that he was in a state of mind which rendered him irresponsible for the act. Medical evidence was adduced in support of this proposition, but it failed to show that the insanity, if it existed, had reached such a degree as to render the accused irresponsible; and it did not appear that any of the circumstances on which the medical witnesses relied as proofs of insanity, had manifested themselves until *after* the perpetration of the crime with which he was charged. The prisoner was convicted, and sentenced to transportation for fourteen years. There was nothing in his case to justify a remission of the usual punishment assigned to arson. Although this case is here noticed under the section of 'Pyromania,' yet, strictly speaking, the defence turned rather upon the alleged existence of general insanity than upon that form of it in which the insanity is supposed to be attended with a propensity to incendiarism. The late Lord Justice-Clerk Hope directed the jury to deal with the case according to the views laid down by the Judges of England, and elsewhere quoted (*ante*, p. 1103). He considered that the insanity to be proved as a ground of exemption must be total—*i. e.* 'the disorder must amount to an absolute alienation of reason. . . . No such principle is recognized in law as that a man, allowing a fancy or morbid feeling to get possession of his mind and temper, although it *disturbs* reason while it does not *overthrow* it, will escape punishment, because, instead of resisting the temptations of such ill-regulated, morbid, distempered, and ungovernable feelings and prejudices (whether called delusions or not), he gives way to them and indulges in their gratification and satisfaction.' These remarks, it will be seen, apply to the plea of insanity in general; and this learned judge further remarks, with respect to the knowledge of right and wrong: 'A man must believe, not that the crime is wrong in the abstract (for most madmen do admit murder to be wrong and punishable in the abstract), but that *the particular act*, committed under the influence of the motive which seems to have prompted it, was not an offence against the law. One may know that in the abstract the act is punishable, and yet believe that his particular act is not in law a crime and not punishable.' From these extracts it will be perceived that the law of Scotland, in reference to the plea of insanity in criminal cases, is substantially the same as that of England.

In *Reg.* v. *Elderfield* (Guildford Summer Assizes, 1844) the prisoner was charged with arson; and Gurney, B., left it to the jury to say, not whether the prisoner had a weak or silly mind, but whether at the time he committed the act he was in such a state of mind as to know what he was about, and to be capable of distinguishing between right and wrong. The prisoner was acquitted on the ground of insanity. In another case (*Reg.* v. *Watts*, Norwich Winter Ass. 1844) the plea was negatived under the direction of the judge. On a more recent occasion (*Reg.* v. *Roberts*, Maidstone Winter Assizes, 1860), Baron Bramwell put the question of responsibility for arson in a still stronger light. Addressing the prisoner, who had pleaded guilty, he said: 'That you are of unsound mind I believe, but that is no reason why you should not be punished. I address the explanation of the reasons why I pass upon you the sentence which I am about to pronounce, not so much to your understanding as to those around who hear me, and to those whose duty it is to notice them. The law makes unsoundness of mind no excuse for offences, except it were such that you did not at the same time know the nature of what you were doing, and that it was wrong and unlawful. No doubt it is very unfortunate that persons of unsound mind should become by that affliction less under the influence of moral restraints and of the restraints of law; but it would be sad indeed for the public if, when those restraints are weakened, the protection of the law were to be withdrawn by the extension of impunity to crime. I am not sure that it is not more necessary to punish a madman than a sane man, so far as the protection of the public is concerned. I feel bound to sentence you to the same punishment as if you were sane.'

KLEPTOMANIA.

Propensity for thieving.—This term has been applied by Marc to that form of monomania which is said to manifest itself by a propensity to acts of theft. It is alleged by him and others that this propensity has often shown itself in females labouring under disordered menstruation, or among those who were far advanced in pregnancy—the motive being the mere wish of possession. Pregnancy, according to him, should be a good exculpatory plea when a well-educated woman, of strictly moral conduct, steals some unimportant article of no value compared with her worldly means and position in society. There are several instances on record showing that well-educated persons moving in a respectable sphere of society have been guilty of petty acts of theft. The articles taken have been valueless compared with their means. Instances of this kind have been brought before our Police-courts, and this motiveless impulse to theft has been occasionally pleaded; but in most of them the following facts have been clearly established by evidence:—1. A perfect consciousness of the act and of its illegality. 2. The article, though of trifling value, has still been of some use to the person,—thus women have stolen articles either adapted to female use, or on which money could be raised. 3. There have been art and precaution in endeavouring to conceal the theft; and 4, either a denial of the act when detected, or some evasive excuse. When circumstances of this kind are proved, either the parties should be made responsible, or theft should be openly tolerated. The evidence of a disordered state of mind should not be allowed to depend on the nature of the act, or every morally depraved person might bring forward a plea of insanity for any crime or offence. (See case, 'Ann. d'Hyg.' 1838, vol. 2, p. 435.) In a case which came before a London Police-court in June 1865, a respectable woman was charged with stealing meat from a butcher's shop. It was alleged in defence that she had committed the theft while in a state of unconsciousness, although she denied possession of the stolen article and endeavoured to conceal it when charged with stealing. A plea of insanity might have led to her committal for trial; but the solicitors who appeared for the defence then said it was not exactly insanity but mental weakness under which she laboured, and this affected her actions. She was fined for the theft, which had all the usual characters of sanity about it.

When the plea of insanity is raised in respect to other cases of stealing, the rule appears to be (per Tindal, C. J.), that there should be proof that the prisoner was incompetent to know that the particular act in question was a wrong one. (*Reg.* v. *Vaughan*, Monmouth Summer Ass. 1844.) In one instance an acquittal took place apparently on the ground of insanity (kleptomania) from amenorrhœa. (Carlisle Summer Assizes, 1845, *Reg.* v. *Shepherd*: Cormack's 'Edin. Jour.' August 1845, p. 632.)

EROTOMANIA. AIDOIOMANIA.

Erotomania has been described by M. Esquirol as a chronic affection of the brain leading to mental disorder, in which amorous ideas are as predominant and as uncontrollable as religious ideas in some cases of religious melancholia. It occurs in both sexes, and in his opinion it differs from nymphomania and satyriasis in the fact, that it has its origin in a primary disturbance of the functions of the brain from disease. In nymphomania, however, the female sexual organs, and in satyriasis the male sexual organs, are at fault. These two conditions he regards as depending on morbid changes in the sexual organs. Dr. Marc has suggested that the term *aidoiomania* (from αἰδοῖον, pudendum) is more appropriate; it signifies *furor genitalis*, and includes both nymphomania and satyriasis. ('De la Folie,' vol. 2, p. 182.)

It cannot be denied that, from sympathy between the genital organs and the brain, mania may sometimes show itself by excessive sexual desires leading to attempts by one on the other sex. When the disorder of the mind is established from the general conduct and conversation of the person, there is no difficulty in recognizing and admitting such cases; but when, on a charge of rape, it is alleged that the assailant laboured under aidoiomania, and was unable to control his desires, it then becomes a serious question how far such a defence is medically, morally, and legally admissible. When it is alleged that a man charged with this crime was led on by an irresistible impulse, and that he had not the power to control himself, it will devolve upon him to satisfy a jury on this point. This is the very difficulty to the admission of such a defence. Excessive amorous propensities may exist in sane and responsible persons, and if unresisted by due moral control, they may in a certain sense be described as irresistible; but this will hardly satisfy a Court of Law that a man could not help perpetrating a rape when time and circumstances were specially favourable for such an assault on a woman. The sane ravisher will generally seek his opportunity—the maniac will attack any woman openly and indiscriminately.

Such a defence is rarely set up in a case of rape, for the reason no doubt that all the circumstances of the case would be adverse to it. I have met with only one instance in which insanity has been pleaded for a criminal assault on a woman; it was tried at Glasgow on the 23rd of December, 1862. The crime was committed on Wednesday the 12th of November. On the following day, in his examination before the Sheriff-substitute, the accused, a married man, æt. 40, appeared to be calm and collected and nowise different from other men. The account he gave of the transaction was, that he thought he was under the influence of the magistrates, and that he would lose his life if he had not connection with the prosecutrix. They had a struggle together, and then he committed the act. His mother proved that he had been subject to fits of an epileptic character, which left him in a stupid state and scarcely conscious of his actions; he was also subject to delusions. It appeared that a few days before the commission of the crime he had several seizures of more than usual violence, and it was suggested that at the time of the act he was under the influence of some of his delusions. The jury returned a verdict of 'not guilty on the ground of insanity.' ('Edin. Monthly Journal,' Feb. 1863, p. 772.) Admitting that some degree of insanity occurring at intervals existed in this man, it is difficult to understand how it manifested itself by forcible intercourse with a woman who was alone and unprotected. The act was perpetrated with a proper attention to opportunity, and under the same animal impulse as would have been manifested by a person not subject to epileptic fits. There was no proof that his insanity had shown itself on previous occasions in a sexual shape, or that it had reached such a pitch as to render him more ignorant than other ravishers of the criminality of the act.

DIPSOMANIA. DRUNKENNESS.

Civil responsibility of drunkards.—This state, which is called in law frenzy or '*dementia affectata*,' is regarded as a temporary form of insanity. Jurists and legislators have differed widely respecting the degree to which drunkards should be made responsible for their acts. When the mind of a man is completely weakened by *habitual* drunkenness, the law infers irresponsibility, unless it plainly appears that the person was at the time of the act, whether of a civil or of a criminal nature, endowed with full consciousness and reason to know its good or evil tendency. Any *deed* or *agreement* made by a party when drunk is not invalidated by our law, except in a case in which the intoxication has proceeded so far as to deprive him of all consciousness of what he is doing; and a Court of Equity will not interfere in other cases, unless the drunkenness was the result of collusion by others for the purposes of fraud. When the drunkenness has occasioned a temporary loss of the reasoning powers, the person is incapable of giving a valid consent, and therefore cannot enter into a contract or agreement; for this implies *aggregatio mentium*, *i.e.* a mutual assent of the parties. Partial drunkenness therefore, provided the person knew what he was about, does not vitiate a contract or agreement into which he may have entered. Thus the law appears to define two states in drunkenness:—one in which it has proceeded to but a slight extent, and it is considered that there is still a power of rational consent; another in which it has proceeded so far that the person has no consciousness of the transaction, and therefore can give no rational consent. The proof of the existence of this last state would render all the civil acts of a person void. A confession made by a man while in a state of drunkenness is legally admissible as evidence against him and others, provided it be corroborated by circumstances. In a case tried a few years since the prisoner confessed, while drunk, that he had committed a robbery and murder which had taken place some time before, but of which he had not been suspected. He mentioned a spot where the property of the murdered person had been concealed by him, and the whole of the circumstances of the murder. The property was found as he had described it, and the case was clearly brought home to him, chiefly by collateral evidence from his own confession. He was convicted. In a case tried at the Central Criminal Court, in October 1849, a man pleaded his drunkenness at the time of his first marriage as a defence to a charge of bigamy. There was some evidence to show that he was partly intoxicated when the ceremony was performed; he was, however, conscious of the whole of the proceedings, and he was convicted. ('Med. Gaz.' vol. 44, p. 762.)

Criminal responsibility of drunkards.—When *homicide* is committed by a man in a state of *drunkenness*, this is held to be no excuse for the crime. If voluntarily induced, whatever may be its degree, it is not admitted as a ground of irresponsibility, even although the party might not have contemplated the crime when sober. (*Reg.* v. *Reeves*, Derby Winter Assizes, 1844.) Thus it appears that when the state of drunkenness is such that any civil act would be void, a person may still be held legally responsible for a crime like murder. Some judges have admitted a plea of exculpation when the crime has been committed in a state of frenzy arising from *habitual drunkenness*; but even this is not general. The question whether the person was or was not drunk at the time of committing a crime may be, however, occasionally of some importance. It was held by Patteson, J., that although drunkenness is no excuse for any crime whatever, yet it is of very great importance in cases in which there is a question of *intention.* A person may be so drunk as to be utterly unable to form any intention at all, and yet he may be guilty of very great violence. (*Reg.* v. *Cruse*, 8 C. & P. p. 546.) If the drunkenness has produced a diseased state of the mind, then a criminal act perpetrated by the person might admit of exculpation on the ground of insanity, or the want of sane consciousness at the time of the act: but the difficulty is to prove in such cases the existence of actual disease to a sufficient degree to render the person irresponsible in a legal sense. When it is a question whether the accused was actuated by malice or not, a jury may under certain circumstances be required to take the fact of drunkenness into their consideration, and this may have some influence upon their verdict. While, then, drunkenness does not furnish any excuse for a crime, it may become material with reference to the *intent* with which an act has been perpetrated. ('Law Times,' Sept. 27, 1845, p. 542.) It is obvious that if drunkenness were to be readily admitted as a defence, three-fourths of the crimes committed in this country would go unpunished.

In cases in which the head has sustained any physical injury, as among soldiers and sailors, drunkenness, even when existing to a slight extent, produces sometimes a fit of temporary insanity, leaving the mind clear when the drunken fit is over. The law makes no distinction between this state and ordinary drunkenness, although juries occasionally show by their verdicts that some difference ought to be made. (See cases in Alison, p. 653.)

Hallucinations and illusions are a common effect of drunkenness, and may lead to the commission of criminal acts. Marc relates a case where two friends being intoxicated, the one killed the other under an illusion that he was an evil spirit. The drunkenness of the accused was held to have been voluntary: and he was condemned to ten years' imprisonment with hard labour. A case of this description (*Reg.* v. *Patteson*) was tried at the Norfolk Lent Assizes, 1840. A man while intoxicated killed his friend, who was also intoxicated, under the illusion that he was some other person who had come to attack him. It is reported that the guilt of the prisoner was made to rest upon the fact, whether, had he been sober, he would have perpetrated the act under a similar illusion! As he had voluntarily brought himself into a state of intoxication, this was no justification: he was found guilty of manslaughter, and sentenced to two months' imprisonment.

The proof of drunkenness may fail, but still, if the party charged with the death acted under an illusion, he will be acquitted. In *Reg.* v. *Price* (Maidstone Summer Ass. 1846), it was proved that the prisoner, who had been on friendly terms with deceased, was going home at night, having previously been in company with deceased at a public-house. According to the prisoner's statement, a man sprang upon him from the hedge by the roadside, and demanded his money and his watch, or else he said he would have his life: the prisoner closed with and beat him severely, inflicting such injuries that he died shortly afterwards. The supposed robber turned out to be his friend, and it was believed that he had made an attempt to rob the prisoner jokingly: the result, however, was that the attempt had ended in this fatal manner. The prisoner throughout told the same story, and there did not appear to be the slightest ground for believing that it was untrue. Coltman, J., after hearing the evidence of the witnesses, said it appeared to be quite clear that the prisoner had acted under an impression that he was protecting his own life from the attack of a robber, and under such circumstances he could not be held to be criminally responsible. The jury accordingly returned a verdict of *not guilty*, and the prisoner was discharged.

Intoxication is simply poisoning by alcohol, a light form of narcotic poisoning. A medico-legal question may arise in reference to the responsibility of persons for acts perpetrated while they are under the influence of other narcotics of a more powerful kind. Thus a person may have lost his self-control from the effects of opium or any of its preparations—Indian hemp, datura, chloroform, or substances of the like nature. If we except Indian hemp (bhang or gunja) and datura (in which muscular power may be excited), the general effect of other narcotics is to produce only a short stage of excitement, which is speedily followed by drowsiness, stupor, and muscular weakness. As a result of taking any of these drugs, a man may have hallucinations or illusions, and in this state commit murder like an insane person, who may fancy that he sees a hideous spectre or the devil before him. Dr. Chevers, in his 'Medical Jurisprudence for India,' describes several instances in which murders have been perpetrated by persons who had taken preparations of hemp (pp. 541 *et seq.*). The legal test of irresponsibility for such acts he states as follows:—'No person can be acquitted unless it can be proved that, by reason of unsoundness of mind *not wilfully caused by himself*, he was unconscious, and incapable of knowing, in doing the act, that he was doing an act forbidden by the law of the land' (p. 566). Persons who voluntarily place themselves in such a condition as to be deprived of all self-control are therefore held responsible: and whether the drug be alcohol, opium, or Indian hemp is immaterial. Cases involving a question of this kind are not very common in England. At the Chelmsford Autumn Assizes, 1861 (*Reg.* v. *Weaver*), a woman was charged with the murder of a child by strangulation. It appeared that this woman had perpetrated the act without any obvious motive, and it was proved that at the time she was in a half-stupefied or unconscious state. She was in the constant practice of taking laudanum, and she had taken a large dose on the morning of the day on which the child was destroyed. It was suggested in defence that she was in such a state of mind as not to be responsible, but the jury convicted her of the murder. Unless there is proof of confirmed disease of the brain as a result of the practice, a person committing a crime while under the influence of drugs voluntarily taken will no doubt be held as responsible for the results as if he were sane.

Restraint. Interdiction.—Drunkenness, even when habitual, is not a sufficient ground for the imposition of restraint or interdiction in the English law. Thus, on a Commission in November 1836 (*Re Holden*), a jury returned that the party was of weak mind and given to habits of drunkenness, but that he was not of unsound mind. On application, the Lord Chancellor refused to interfere. This part of our law requires revision.

The case of *Mrs. Armstrong* (Queen's Bench, February 1858) presents some features of interest in reference to the alleged mental unsoundness of drunkards. The defendant, a lady æt. 58, had been declared of unsound mind by a Commission in August 1857. In September she escaped, and went to France: she returned to this country in January 1858, and endeavoured to set aside the verdict of unsoundness by these proceedings. It appeared that her father had bequeathed to her by his will two thousand pounds per annum, to be paid to her monthly by trustees. The evidence at the trial showed that she was ill-educated, ignorant, and naturally of weak mind, amounting, according to some of the witnesses, to imbecility. For about ten years she had given way to habits of excessive drinking, and these habits, according to the evidence for the Crown, had still further weakened her intellect. She had been confined four times in lunatic asylums, and her unsoundness of mind had been certified by Drs. Arnott, Conolly, Forbes Winslow, and others.

On the part of defendant it was contended that her mind was sound, except when she gave way to drunkenness, and that by the cessation of this habit she would be perfectly sane and competent to manage herself and property:—further, that a mere drunkard could not and ought not to be deprived of his civil rights, unless it was proved that his mind had become permanently disturbed by his vicious habits, and this it was contended had not been proved of the defendant. Dr. Conolly, however, testified that, although she was a year under his supervision without any access to drink, her mind was still unsound.

It appeared also that she had no control over herself in this respect: for when she escaped to France it was proved that she still drank brandy to excess, and for a month was drunk almost daily. Drs Monro, Baly, Wood, and myself saw this lady on several occasions previous to the trial, for the purpose of testing her state of mind. We found her weak-minded, evasive, untruthful; and although sober at the time of our visits, it was clear from her admissions that she still drank wine and spirits in excess. She denied that she had ever been insane; and admitted that, although she had hoarded 3,200*l*. in sixteen months, she had not paid her tradesmen's bills, and had incurred a large debt at an hotel for which an action had been brought against her husband. She refused to give any account of the disposal of her money, or to furnish any explanation in reference to the large sum accumulated.

Having heard at the trial the evidence respecting her unsoundness previous to the inquisition, and having remarked an entire absence of proof that this had been removed when she was left to her own control, Drs. Monro, Baly, and myself came to the conclusion that from original weakness of intellect, aggravated by habits of drinking, she was of unsound mind and incapable of taking care of herself or her property. Upon this declaration no witnesses were called for the defence; and the jury, who had an interview with the lady, returned a verdict that she was of unsound mind,—two out of the twelve stating that her mind was sound, but that she was incompetent to manage her affairs on account of her habitual drunkenness. These two jurors therefore considered that she was a dipsomaniac. If this view were correct, she ought to have been discharged, as such persons are not subject to restraint or interdiction by the English law. There was no evidence, however, to show that she had recovered, while there was evidence that abstinence from drink at a former period had not led to her recovery. These dissentients must have based their opinion on their own personal judgment of her condition after a short interview.

An excessive indulgence in habits of drinking does not necessarily derange the mind, but it practically renders a person unfit for the control of himself and the management of his property. It is therefore a question whether it would not be for the benefit of such persons and of those dependent on them if the law interfered, and placed them under the same restraint as those whose minds had been actually rendered unsound by this pernicious habit.

DELIRIUM TREMENS.

This is a disordered state of mind which proceeds from an abuse of intoxicating liquors. Habitual drunkenness appears to be the predisposing, while abstinence from drink is the immediately exciting, cause. Thus, the disorder frequently does not show itself until the accustomed stimulus has been withdrawn for a certain period. It commences with tremors of the hands, by which it is known from ordinary delirium, and restlessness; and the individual is subject to hallucinations and illusions, sometimes of a horrible kind, referring to past occupations or events. The patients are often violent, and prone to commit suicide or murder—more commonly the former; hence they require close watching. Persons labouring under this disorder are incompetent to the performance of any civil act, unless the mind should clear up before death; they are not responsible for criminal acts committed while they are labouring under an attack. Acquittals have even taken place on charges of murder, when there was deliberation as well as an apparent motive for the act. Thus then, although this disorder may have been voluntarily brought on by habitual drunkenness, the law admits it as a sufficient plea for irresponsibility, while in a case of confirmed drunkenness it rejects the plea. In delirium there is a formed disease of the brain, while voluntary drunkenness merely produces a temporary disturbance of its functions. A trial has taken place in which the evidence showed that homicide had been committed by the accused while labouring under an attack of delirium tremens. (*Reg.* v. *Simpson*, Appleby Summer Assizes, 1845.) The prisoner's mind had become unsettled from this disorder, brought on by habitual drunkenness. In another case the plea was also admitted by the jury, although it was scarcely supporte dby the medical evidence. (*Reg.* v. *Watson*, York Winter Assizes, 1845.)

SOMNAMBULISM.

This term applies to sleep-walking, but the medico-legal facts are chiefly confined to acts of violence perpetrated unconsciously during the state of sleep, in which it is presumed that malice and intention, the chief ingredients of crime, are wanting. It has been a contested question among medical jurists, how far a person should be held responsible for a criminal act perpetrated in that half-conscious state which exists when he is suddenly roused from sleep. There is no doubt that the mind is at this time subject to hallucinations and illusions, which may be more active and persistent in some persons than in others; but it is difficult to suppose, unless we imagine there is a sudden access of insanity, that a person should not recover from the delusion before he could perpetrate an act like murder. A remarkable case of this description, that of *Bernard Schedmaizig*, will be found reported by Marc. (Op. cit. vol. 1, p. 56.) This man suddenly awoke at midnight, and saw, as he believed, a frightful phantom. He twice called out, 'Who is that?' and receiving no answer, and imagining that the phantom was advancing upon him, he seized a hatchet which was beside him, attacked the spectre, and it was found that he had murdered his wife. He was charged with the murder, but pronounced 'not guilty' on the ground that he was not at the time conscious of his actions. A trial involving this question occurred in England. A pedlar in the habit of walking about the country armed with a sword-stick, while lying asleep on the highroad, was roused by a man accidentally passing, who seized and shook him by the shoulders. The pedlar suddenly awoke, drew his sword and stabbed the man, who soon afterwards died. The pedlar was tried for manslaughter. His irresponsibility was strongly urged by his counsel, on the ground that he could not have been conscious of an act thus perpetrated while in a half-waking state: this defence was supported by the opinion of a medical witness. The prisoner was, however, found guilty. Under such circumstances, it was not unlikely that an idea had arisen in the prisoner's mind that he had been attacked by robbers, and therefore had stabbed the man in self-defence. (*Rex* v. *Milligan*, Lincoln Autumn Assizes, 1836.) The following remarkable case is quoted by Mr. Best:—Two persons who had been hunting during the day slept together at night. One of them was renewing the chase in his dream, and imagining himself present at the death of the stag, cried out 'I'll kill him!—I'll kill him!' The other, awakened by the noise, got out of bed, and by the light of the moon beheld the sleeper give several deadly stabs with a knife on that part of the bed which his companion had just quitted. Suppose a blow given in this way had proved fatal, and the two men had been shown to have quarrelled previously to retiring to rest! ('Presumptions of Law and Fact.') A defence of this kind may, however, be unduly strained. Thus when there is enmity, with a motive for the act of homicide, the murderer, while sleeping in the same room, may select the night for an assault, and perpetrate the act in darkness in order the more effectually to screen himself. In *Reg.* v. *Jackson* (Liverpool Autumn Assizes, 1847), it was urged in defence that the prisoner, a woman who slept in the same room with the prosecutor, had stabbed him in the throat, owing to some sudden impulse during sleep; and the case of *Milligan* (above given) was quoted by the learned counsel in support of the view that the prisoner was irresponsible for the act. It was proved, however, that the prisoner had shown malicious feeling against the prosecutor, and that she had wished him dead. The knife with which the wound had been inflicted bore the appearance of having been recently sharpened, and the prisoner must have reached over her daughter (the prosecutor's wife), who was sleeping in the same bed with him, in order to inflict the wound. These facts were adverse to the supposition of the act having been perpetrated in a state of unconsciousness in awaking from sleep, and the prisoner was convicted. In *Reg.* v. *Minchin* (Cent. Crim. Court, June 1853), in which a young woman was charged with having wounded the prosecutor during the night, the same plea was put forward but rejected. There was nothing to show that the prisoner was not aware of what she was doing. There was an absence of motive, but, as it has been elsewhere stated, this alone does not create irresponsibility. In another case (*Reg.* v. *French*, Dorset Autumn Assizes, 1846) it was proved that the prisoner, while sleeping in the same room, had killed the deceased, who was a stranger to him, under some delusion. There was, however, clear evidence that the prisoner was insane, and on this ground he was acquitted under the direction of the judge. In *Reg.* v. *Byron* (Winchester Winter Assizes, 1863), it was proved that a blow struck by a drunken person during sleep had caused death. The man was charged with manslaughter, under the following circumstances:—The prisoner and deceased were soldiers in the same regiment, at Aldershot. The prisoner was in the street drunk, and deceased seeing this took him in, to prevent his being arrested for drunkenness, and placed him on his bed. In this state he lay for some time quite drunk and insensible. In the course of the afternoon deceased went upstairs to see him; he tried to awaken him, when the prisoner suddenly kicked out, and his boot came violently against the lower part of the abdomen of deceased. The prisoner did not awake, but appeared then to be quite insensible. The deceased died, and it was found that the blow had caused rupture of the intestines. As in order to constitute the crime of manslaughter, it must be shown that the person charged did something knowingly, and the prisoner was not in a state to have known anything, it was held that there was no case against him, and he was acquitted. The act was committed during sleep, but the sleep appears to have been the result of drunkenness.

Somnambulism may become a subject of discussion under a contested policy of life-insurance, in which it may be provided that it shall be vitiated by suicide. If a man falls from a height and is killed while in a state of somnambulism, would this be considered an act of suicide within the meaning of the policy? The proviso against suicide has been held to include only *intentional* killing (case of *Borradaile* v. *Hunter*, p. 1039; also 'Med. Gaz.' vol. 36, p. 826), and in death under these circumstances the killing cannot be said to be intentional: it can only be regarded as an accident—therefore it is reasonable to infer that the policy would not be void. It is impossible, however, to lay down any general rules relative to cases of this description; since the circumstances attending each case will sufficiently explain how far the act of murder or suicide had been committed during a state of somnambulism, or under an illusion continuing from a state of sleep.

THE DEAF AND DUMB.

It was formerly laid down in the old law-books, that a person born deaf and dumb was by presumption of law an idiot, but in modern practice, want of speech and hearing does not imply want of capacity either in the understanding or memory, but only a difficulty in the means of communicating knowledge; and when it can be shown that such a person has understanding, which many in this condition discover by signs, he may be tried, and suffer judgment and execution. (Archbold.) A deaf-and-dumb person is not incompetent to give evidence, unless he is also blind; he may be examined through the medium of a sworn interpreter who understands his signs. This condition does not justify restraint or interdiction, unless there is at the same time mental deficiency. A deaf-and-dumb person who has never been instructed is altogether irresponsible for any action, civil or criminal. Such a person cannot even be called on to plead to a charge, when there is reason to suppose that he cannot understand the nature of the proceedings. A deaf-and-dumb woman was charged with cutting off the head of her child. By signs she pleaded 'not guilty,' but she could not be made to understand the nature of the other proceedings against her. Upon this she was discharged, and subsequently confined as a criminal lunatic. In *Reg.* v. *Goodman* (Stafford Summer Assizes, 1841) a deaf-and-dumb man was convicted of theft and sentenced to imprisonment. He was made to comprehend the proceedings by signs and talking with the fingers. In *Reg.* v. *Brook* (Buckingham Summer Assizes, 1842) the prisoner could read and write well. He was charged with feloniously cutting and stabbing. The proceedings were reported to him in writing. He was convicted, and the judge (Alderson, B.) having sentenced him to a year's imprisonment, handed down his judgment in writing, which he recommended him to read and ponder over in prison! In *Reg.* v. *Jackson* (Bedford Summer Assizes, 1844), Alderson, B., held that before the evidence of a dumb witness can be received, the Court must be satisfied that he understands the obligation of an oath.

It has been decided in the Ecclesiastical Courts that the consent of a deaf-and-dumb person given by signs renders a matrimonial contract valid, provided the person has a full and proper understanding of their meaning. An incompetency to enter into contracts or unsoundness of mind must not be inferred to exist merely in consequence of a person being deaf and dumb. In the case of *Harrod* v. *Harrod* (Vice-Chancellor's Court, June 1854), an attempt was made to deprive the plaintiff of his rights on the ground that he was an illegitimate child. The marriage of his parents took place thirty years previously, but the marriage was said to be void by reason of the alleged incapacity of his mother to enter into the contract; the mother was deaf and dumb, and of more than ordinarily dull intellect. Sir W. P. Wood said there was an important difference between 'unsoundness of mind' and 'dulness of intellect.' The presumption in such cases was always in favour of sanity, and the fact of a person being deaf and dumb did not raise a presumption the other way. Experience in asylums showed that the deaf and dumb were not necessarily of unsound mind. The woman had assented to the marriage in form and substance, and with a perfect knowledge of what she was doing. In the ceremony of marriage it had never been held that the repetition of the words was necessary. The woman conducted herself with great propriety before and after the marriage, and a child was born in due course. There was no ground for an issue.

Feigned deafness and dumbness.—From these statements it will be perceived that medical evidence is of but little importance in relation to the deaf and dumb. Indeed, there are only two cases in which this kind of evidence is likely to be called for—1st, when there is accompanying *mental deficiency*, in which case the general rules elsewhere given are applicable (p. 1045); and 2ndly, when there is a suspicion that the deafness and dumbness are *feigned*. There will be no great difficulty in detecting an imposition of this kind. It may be found that the alleged deafness and dumbness did not come on until a motive existed, and that there was no apparent cause but the very suspicious one of evading responsibility for some offence committed. The use of ether or chloroform-vapour may be occasionally resorted to with advantage for the detection of such an imposition. In one instance a strong shock of the induced current from a large magneto-electrical apparatus, by means of moistened conductors applied over the larynx, brought out after a few minutes the power of speech in a lad who had successfully imposed on many persons. ('Med. Times and Gaz.' March 30, 1861, p. 339.) It requires great skill to maintain an imposture of this kind. Such persons are immediately thrown off their guard by addressing them in a voice a little above or a little below the common conversational tone; a change in the eye or the features will at once indicate that they hear and understand what is said. An ignorant impostor may be dealt with on the principle of '*artis est celare artem*,' by seriously proposing in a low voice to a medical friend who may be present, the necessity for the performance of some formidable surgical operation. The production of amputating instruments has been known to have a wonderful effect! In *Reg.* v. *Yaquierdo* (Herts Summer Assizes, 1854) the prisoner, who was charged with wilful murder, was found by the jury to be wilfully mute. The man refused to plead, although it was obvious that he was well aware of the nature of the proceedings. No counsel could be assigned to him, as this could not be done without the prisoner's consent. He was convicted and sentenced. If the impostor can write, he may perhaps be detected by the ingenious plan adopted by the Abbé Sicard. When the deaf and dumb are taught to write they are taught by the eye. The letters are only known to them by their form, and their value in any word can be understood only by their exact relative position with respect to each other. A half-educated impostor will spell his words, or divide them incorrectly; and the errors in spelling will always have reference to sound—thereby indicating that his knowledge has been acquired through the *ear*, and not alone through the eye. A man who had defied all other means of detection wrote down several sentences, in which the misspelling was obviously due to errors produced by the *sound* of the words; the Abbé pronounced the man to be an impostor without seeing him, and he subsequently confessed the imposition.

LIFE INSURANCE.

CHAPTER 87.

PRINCIPLES OF LIFE INSURANCE—QUESTIONS TO PERSONS WHO INSURE THEIR LIVES—MEDICAL QUESTIONS—WHAT DISEASES HAVE AND WHAT HAVE NOT A TENDENCY TO SHORTEN LIFE?—LEGAL DECISIONS RESPECTING THE MEANING OF THESE WORDS—CONCEALMENT OF DISEASES—WHAT IS MATERIAL CONCEALMENT?—CONCEALMENT OF HABITS—WHAT IS INTEMPERANCE?—PROXIMATE AND REMOTE EFFECTS—DELIRIUM TREMENS—EPILEPSY—PHTHISIS—ABSTINENCE—VEGETARIANISM—OPIUM-EATING—INVETERATE SMOKING—INSANITY—VOIDANCE OF POLICIES BY SUICIDE—SECRET POISONING OF PERSONS WHOSE LIVES ARE INSURED.

THE subject of Life Insurance in a medico-legal view is almost peculiar to the medical jurisprudence of Great Britain. This arises from the extent to which insurances on lives are effected in this country, and from the peculiar nature of the provisions which regulate contracts of this description.

The insurance of a life is a contract whereby the insurer, in consideration of a certain sum of money, called a *premium*, either in a gross sum or in periodical payments—proportioned to the age, sex, profession, health, and other circumstances of the person whose life is insured—undertakes to pay to the person for whose benefit the insurance is made a stipulated sum or an equivalent annuity, upon the death of the individual whose life is insured, whenever this event shall happen, if the insurance be for the *whole* life; or, in case this shall happen within a certain period, if the insurance be for a limited time.

The deed by which this contract is made is called a *policy*, and it is concerning the stipulations of the policy, and the meaning to be put upon certain medical terms used in it, that litigation commonly arises. The amount of premium payable will be regulated by the *mean expectation* or duration of life of the individual; and this it is well known is not only different at different ages, but is greater at certain periods of life in women than in men. One fact, however, is certain,—the most successful Insurance Offices have considerably underrated the probability or expectation of life among adults, and thus have derived enormous profits by demanding higher premiums on the insured than a fair view of the rate of mortality would justify. The calculations of some of the older Offices were based on what is called the Northampton Table, which represents in an exaggerated degree the mortality not only of the class of persons who commonly effect insurances, but of the entire population. This table has been thus improperly applied to determine the mortality of men in the middle classes, holding the most durable tenure of life. Besides this, as Mr. Edmonds has shown, some of the Offices have entirely excluded from insurance the sick class, out of which the greater part of the mortality indicated in the table necessarily takes place. By excluding the sick, and requiring strong medical certificates respecting the condition of healthy applicants, it follows that the mortality among the insured falls immeasurably short of that which is indicated by the ordinary Tables of Mortality from which the amount of premium is really calculated.

The sum for which a person's life has been insured cannot be recovered until after the death of the person and distinct proof of death. Those who would benefit by the death must prove the fact of death when this is open to doubt. In another part of this volume (p. 120) a case is reported in which a claim was made on an Insurance Company for the amount of a policy on the life of a man who suddenly disappeared, while at Brighton, within a week after the insurance on his life had been effected. The man's clothes were found on the beach, and the jury were asked to infer from this fact that the man was drowned, and that his body had been carried out to sea. No one had seen him go into the water. The jury were discharged without a verdict. It was quite possible that the clothes had been designedly placed there, and that the man had gone off in another direction, and was still living.

Different rules have been given by actuaries for calculating the expectation or duration of life at different ages. It is difficult to test their accuracy, except in reference to large numbers of persons living under similar circumstances, and for these groups of the population statistics do not fairly provide. Age is the point from which nearly all the Tables of Mortality start, without reference to health, trade, occupation, or social position. One of the most simple of these rules for calculating the duration of life from 5 to 60 years has been given by Willich: he considers it to be equal to two-thirds of the difference between the age and 80. Thus, in a man 20 years of age the difference is equal to 60, and two thirds of this are equal to 40, the probable duration of life for a person of average health at 20. Each Office has its own rules for calculating the amount of premium to be paid by the person who effects an insurance. As Insurance Offices are very numerous and their profits are large, it is obvious that their calculations must be very much in their own favour. The expectation of life in the insured is ordinarily much greater than they assign to it; at the same time the amount payable in the form of premium is kept down by competition.

With respect to the influence of *profession*, a higher premium is demanded by some Offices for the insurance of the lives of persons whose occupations expose them to great risk—as, for instance, of persons actually engaged in military or naval service. The rule adopted with respect to professions in one of the best London Offices is as follows:—'No extra premium is required from any person in the Army or Navy unless on actual service, but the assurance will be void if the party whose life is assured enter into any naval or military service whatever, unless by consent of the Directors endorsed on the policy.'

Above all other conditions, *the general state of health* of the person is likely to have a most important influence on the mean duration of life; and it is here that medical science lends its aid—1st, by showing how far a contract may be safely entered into when the person is affected with disease; and 2ndly, by showing whether a diseased state of the body really existed in the person insured, although at the time of insurance it may have been alleged that he was healthy and free from disease.

By improved methods of diagnosis, the existence of disease under a proper examination is easily made known, or it may be at once inferred from symptoms described by non-professional persons. Then, again, the influence of particular diseases in shortening life are now so much better understood than formerly, that numerous Offices have of late years been especially established for the insurance of *diseased* as well as of healthy lives, the amount of premium being of course regulated by the nature of the disease and the degree to which it may have advanced. In these cases lives are insured as if the persons had reached a greater age, the amount paid being calculated on the theory that the person is ten, fifteen, or twenty years older than he is.

As in the case of all civil contracts the law requires that there should be a strict compliance with the conditions by each party, it follows that, if any fraud has been committed by the insured—if he, or those to whom he trusted in his dealings with the Office, have concealed from the insurers the existence of any disease under which he was at the time labouring, or any symptoms indicative of a probable attack of disease—or if he or they have knowingly and wilfully misrepresented or misdescribed his actual bodily condition, then the contract will be void, and the amount of the premiums forfeited. This forfeiture is a usual condition in the policy. Actions on policies of life-insurance are not unfrequent; and, unfortunately, the medical evidence given on these occasions, as in cases of insanity, is of a very conflicting character. This is by no means creditable to the profession, for it either proves the existence of great bias in the witnesses, or that medical rules are devoid of all certainty, and are therefore practically useless. A writer, in commenting upon these professional conflicts, says: 'One of the most unsatisfactory parts of our law of evidence is that which relates to the testimony of experts. It is impossible to shut out such evidence altogether, but there is nothing which brings more discredit upon the administration of justice. There is one consequence of its admission which is common to all cases in which it occurs. It is, that no difficulty has ever been found in obtaining any amount of evidence of this description on either side of any point at issue.' It will be therefore necessary to enter into an examination of the circumstances under which medical men are called upon to appear. An action is never likely to be brought for the recovery of the amount of a policy, except in those cases where there is reason to suspect that a wilful fraud has existed in the contract. Juries always regard such actions with disfavour; and while judges interpret the law strictly, the onus of proof is entirely thrown upon the Offices. Hence the insured are placed in a very advantageous position. These actions in nine cases out of ten depend upon the construction put on the medical terms of the contract; hence it is our duty to see how medical defects are likely to arise in reference to the policy. The conditions of insurance vary in different offices. The following are taken from the papers issued by one of the principal London Offices:—

Questions.—The name, residence, and profession of the party whose life is to be assured? Place of birth? Date of birth? the — day of —. Age *next* birthday —years'? (*Proof should be furnished.*) Married or single? Sum to be assured, £ . Term for which the assurance is required? Have you ever been afflicted with gout, rupture, asthma, fit or fits, spitting of blood, or any other disease or disorder which tends to shorten life? Have you had the smallpox, or been vaccinated? Have any of your relatives died of consumption? Are you now, and have you always been, of temperate habits of life? Are you employed in any naval or military service? State if there be any other material circumstance touching your past or present state of health or habits of life to which the foregoing questions do not extend? Name and residence of your usual medical attendant? Has attended me — years. Name, residence, and profession of TWO friends well acquainted with your health and habits of living? Has known me — years. Has known me — years. Has a proposal ever been made on your life at any other office or offices? If so, where? Was it accepted at the ordinary premium? or at an increased premium? or declined? I, the abovenamed ——, do hereby declare that the foregoing statements, and the answers and replies made by me to the several above-mentioned questions and requisitions, and each and every of them, is and are true in substance and matter of fact. And that I have not omitted or concealed any fact, matter, or thing in anywise touching or affecting my state of health, constitution, or habits of life. And I also declare, that it is expressly understood and agreed between myself and the Company, that the foregoing particulars, statements, and this declaration are to be considered and taken as the basis of the contract of assurance between me and the Company, for this assurance. And in case the foregoing particulars, statements, and declaration be untrue, or contain any untrue averment, the policy of assurance effected in pursuance thereof shall, in any or either of such cases, be absolutely null and void, and the premiums paid thereon shall become and be absolutely forfeited to the Company, and not be receivable or recoverable by me or by my representatives. Dated the — day of — 186—. Signature of the person .

The following questions are submitted to the usual medical attendant of the person whose life is proposed for insurance:— 1. How long have you known him? 2. Are you his usual medical attendant? and have you seen him with reference to this report? 3. When was he last ill? and what have been the nature and duration of the complaints for which you have attended him? 4. Has he to your knowledge, or have you reason to believe that he has had, any giddiness, or affection of the head, or any particular determination of blood to the head; or has he suffered from apoplexy, palsy, epileptic or other fits, or other disease of the brain, or from insanity? 5. Has he ever suffered from pulmonary disease? from habitual cough, shortness of breath, spitting of blood, asthma, inflammation, or other disease of the lungs, or from disease of the heart? 6. Has he ever had dropsy, inflammation, or severe disease of the bowels, disease of the liver, of the kidneys, or other urinary organs, or any affection of the alimentary canal? 7. Has he had gout or rheumatism? If so, in what form? and have the attacks been frequent? 8. Has he ever been affected with hernia? If so, in what situation? Is it reducible? And does he wear a truss? 9. Has he had any serious wound, hurt, or other accident, causing any bodily infirmity? 10. Do you consider he is now in perfect health? 11. Has he been, and is he now, habitually sober and temperate? 12. Is he of active or sedentary habits? 13. Does his occupation expose him to the chances of disease? 14. Have his parents been healthy and long-lived, or otherwise? 15. Have any of his near relatives died of consumption or any hereditary disease? 16. State any material circumstance touching his health or habits, to which the foregoing questions do not extend, which may affect the eligibility for life assurance? Dated this — day of — 186 —. Signed ———.

In order to show the searching nature of these inquiries, and how one set of answers is made to act as a check upon another, it is only necessary to refer to the following list of queries which are put to private individuals acquainted with the person. This paper is to be filled up and transmitted with a proposal for life-insurance:—

State whether you have been acquainted with the person whose life is proposed to be insured, and how long. Whether you have ever known or heard of his being ill, and, if so, state the time of the illness and nature of the complaint. Whether he is at this time, to the best of your knowledge and belief, in perfect health. Whether his *habits* and manner of living are temperate and regular. (You will be pleased to direct your particular attention to this subject of inquiry.) Whether his appearance indicates health and a good constitution. Whether there is any, and what, apparent defect in the formation of his person. When you last saw him. Whether he is in person thin or middle-sized, stout or bloated. Whether his complexion is pale, sallow, brown or florid. Whether he is married or single. Whether he has had any brothers or sisters. If so, how many; the number now living; the ages at which the others have died, and the cause of their decease. Ascertain and state whether his parents are living, and, if not, the age at which they have died, and the causes of their death; communicate all the information you can acquire as to the health and longevity of his other relatives; also whether any of them have died of consumption, or have been subject to fits or mental derangement. Whether the persons referred to, respecting the life to be insured, are worthy of credit; and whether the medical referee is the usual medical attendant of the party. Whether you consider the life in question in all respects safe and proper to be insured by the Company upon ordinary terms, and whether you recommend the same to the Directors as such. Ascertain if the life has been proposed in any other Office, and if so, whether declined or taken. If the insurance is proposed by one party on the life of another, endeavour to learn and state the object for which it is intended.

No one can blame Insurance Offices for acting thus rigorously. Frauds of the worst description have been frequently attempted upon them, and it is only by the adoption of a system of this kind that they can protect themselves.

The practice with some Offices of obtaining a certificate gratuitously from the medical attendant of the person proposing to insure his life is one great source of litigation. The responsibility of causing the life to be accepted or rejected is thus thrown entirely upon the usual medical attendant of the person; for, as we shall see hereafter, an application for a certificate from a medical practitioner, who is a stranger, is very likely to be treated as a fraud, and to lead to the disputing of the policy. The medical attendant of the person, it is true, is the only individual who can properly certify to the real state of health, and therefore to him an application is generally made. He is sometimes expected to furnish an important certificate of this kind gratuitously; and should it happen to be unfavourable, he is exposed to the risk of losing what may probably be a lucrative portion of his practice: for I shall not suppose that any member of the profession would certify to what he knew to be untrue in order to retain a patient. The question is, whether an Insurance Office has a right to place a medical man in such a responsible position as this. In the issuing of a policy the insurers and insured are equally benefited, for the contract would certainly not be made except upon a supposition of reciprocal benefit. The medical attendant, without whose sanction the policy could not be properly effected, not only derives no benefit, but is actually exposed to the risk of loss for performing in an honourable and conscientious manner an invidious duty thus forced upon him. Such a state of things ought not to be. Many actions for the recovery of disputed policies have shown most clearly that the practice leads to great carelessness and indifference on the part of medical men in drawing up these certificates; and this produces in the end a more serious loss to the representatives of the insured than if the life had not been accepted. It must be remembered that the insurers do not suffer by any misconduct on the part of a medical man who signs such a certificate, but the representatives of the insured; hence the Offices show no disposition to amend this vicious system. It is always professed that such communications are confidential; but in more than one instance medical men have found that the contents of their certificates have become known to their patients, and have even been publicly used as evidence in Courts of Law. A partial remedy would be, that the medical attendant of the party should not be called upon to sign a certificate at all, but that this should be done only by a medical referee of the Office after a regular professional consultation with the medical attendant, and a proper examination of the person. If the life were rejected, the onus of rejection would be on the proper person, the appointed referee; and if accepted, he would be properly made responsible to the

Office for any gross negligence in the performance of his duties. It is true that there are few Insurance Offices which have not consulting physicians and surgeons attached to them; but the weight of responsibility in contested suits does not rest with these officers so much as with the medical attendants of the insured. In the event of a medical practitioner being called upon to sign a certificate of this kind, it appears to me that the safe plan to be adopted would be that he should decline the proposal, except upon a professional consultation with the medical officers appointed by the insurers. If, however, from private considerations, he is compelled to sign the certificate, it is his duty to use the greatest caution, not merely in returning answers to the formal questions on the paper, but in detailing *all particulars known to him respecting the state of health of the person.* In acting otherwise, he would be doing the greatest possible injury to the representatives of the insured, and probably damage his own reputation. There is no intermediate course: the duty must either be performed carefully, conscientiously, and honourably, or it must be declined altogether. It is a fallacy to suppose that any equivocation or concealment in the declaration can escape detection; and yet, from the evidence which has been given on some trials, it is probable that such an idea had existed in the mind of the medical attendant who placed his name to the certificate.

Let us take the case, however, that this preliminary duty has been properly performed; important medical questions may arise respecting the alleged infringement of the conditions of the policy. The list of diseases specified comprises a great variety—affections of the head, apoplexy, palsy, epileptic or other fits, disease of the brain, insanity, disease of the lungs, spitting of blood, asthma, inflammation, disease of the heart, dropsy, diseases of the bowels, liver, kidneys, or urinary organs, gout, rheumatism, hernia, phthisis, or any hereditary disease. In the proposals of some Offices the mysterious word 'fits' occupies a very prominent position, but it is difficult to say what this word thus isolated actually means. It appears to have been borrowed from the vocabulary of the ancient searchers under the bills of mortality in the reign of Charles II. Thus it may comprise apoplexy, epilepsy, paralysis, syncope, convulsions from any cause, and even asphyxia. The word is too indefinite for a certificate, and should be expunged. In the meantime, a Court of Law will not allow insurers to benefit by the use of ambiguous terms in the contract, and it has therefore commonly restricted the meaning of the word 'fits' to attacks of epilepsy. The main condition, however, is involved in the terms—'*any other disease or disorder tending to shorten life.*' Upon the meaning of these words litigation commonly turns, and the opinions of medical experts are required.

Diseases tending to shorten life.—It is impossible to lay down any general rules for determining what diseases have and what diseases have not a tendency to shorten life. Any deviation from health might be so interpreted; but the law puts a proper limitation here upon the meaning of the words, considering them to apply to those diseases only which, in a medical view, are regarded as of a serious nature, and, as a general rule, are likely either directly or indirectly to affect the duration of life of any person labouring under them. This question was brought to an issue in the case of *Watson* v. *Mainwaring*, in which payment of the amount of a policy was refused, because the insured had laboured at the time under what was called *organic dyspepsia*: and this fact was kept concealed from the insurers. It was left as a question of fact to the jury, whether the malady with which the deceased was afflicted, and of which he ultimately died, was an ordinary or organic dyspepsia at the time of the insurance. The judge (Chambre) in charging the jury said: 'All disorders have more or less a tendency to shorten life, even the most trifling; as, for instance, corns may end in mortification: but that is not the meaning of the clause. If dyspepsia were a disorder tending to shorten life within this exception, the lives of half the members of the profession of the law would be uninsurable.' We learn then, from this case, that a person may die from a disease under which he was labouring at the time of insurance; and yet if it be not the common course of that disease to shorten life, the representatives may recover the amount of the policy. This is an equitable interpretation of the terms; for the insurers have no right to give a forced meaning to the words of the policy, and to take advantage of what must be regarded as an accidental result. From other decisions we learn that, in order to render a policy valid, these words do not imply that the insured must have been at the time entirely free from all the seeds of disorder or latent disease. Such a condition is impossible. A man may be labouring under some insidious disease,—ulceration of the stomach or intestines, for instance— leading to perforation; but if this be, as it commonly is, unknown both to himself and his medical attendant, the insurers are bound to take the risk. Lord Mansfield, in the case of *Sir James Ross*, held that the warranty was sufficiently true, if the person were at the time in a reasonably good state of health. A life may be a good life, although the person may be at the time labouring under some bodily infirmity.

On the other hand, a disease tending to shorten life must not be taken to signify only one of those maladies which have commonly a rapid and fatal course—as phthisis and scirrhus: it may apply to dropsy, gout, asthma, insanity, and many diseases of a chronic character. When the existence of these diseases, or even a well-marked *tendency* to them, is concealed from the insurers, or omitted to be stated through mistake, even without fraudulent intention, the policy in the event of death becomes void, because the risk incurred is really different from the risk understood and intended at the time of the agreement. Such diseases are not necessarily fatal, but this is not the question: their *tendency* is to diminish the expectation of life, and if medical evidence establish this with regard to any disorder intentionally concealed, whether chronic or acute, the contract is at an end.

Gout.—In December 1862, a case was tried in which it was alleged that there had been concealment of the existence of gout. (*Exors. of Fowkes* v. *The Manchester and London Assurance Company.*) The deceased Fowkes, a commercial traveller aged 49, in the year 1860 effected a policy on his life for 1,000*l.* He died in June 1861. Payment was refused on the ground that the answers of deceased were untrue, and that there had been suppression of a material fact. It seems he was asked whether he had ever been *afflicted with gout*, and he answered 'No.' He was asked whether the life had been offered at any other Office, and, if so, whether it was accepted; and he answered that it had been proposed, and had been accepted at an ordinary rate. These were the answers which it was alleged were false. On the part of the Company, a surgeon stated that in May 1858 deceased was suffering from suppressed gout. He had an 'extremely slight attack,' which lasted only about forty-eight hours; he did not tell the deceased that it was gout; he believed that he died of suppressed gout in an aggravated form. A proposal of the deceased to another Company, which had been declined, was put in evidence. On the part of the plaintiffs it was contended that there was no evidence that deceased had ever been 'afflicted with gout.' The Lord Chief Justice left it to the jury—first, whether the answers of the insured were untrue; and next, whether they were false to his knowledge. First, had he been 'afflicted with gout'? The question must be considered with some reasonable latitude, and it was not because a person had some passing symptoms which a farseeing medical man might ascribe to the presence of suppressed gout in the system, but whether there was gout in a sensible appreciable form? This certainly was stated before the proposal, to have been 'the slightest possible case' of gout, according to the medical evidence. As to the other question—whether the life had been proposed at any Office and accepted or declined—it appeared that the life had been proposed at two Offices, and accepted by one but declined by the other. Had the assured answered truly in simply saying that he had proposed and been accepted? The question no doubt was not in the most comprehensive form, but was it answered fully and fairly, and according to its obvious meaning and effect, by saying nothing of the proposal which had been declined? He thought not; but left it to the jury. He, however, thought further that it was not strictly true that the life had been 'accepted' in the sense in which the word was used—for it had not been accepted by any Office on a proposal for assurance, but merely approved by the medical man. It was for the jury to say whether either of the answers was untrue, and, if so, whether either was untrue to the knowledge of the assured. The jury found that the assured had not been afflicted with gout at the time of the proposal; also that the answer to the other question was untrue, but not to his knowledge. The Lord Chief Justice directed a verdict for the plaintiff, subject to a point reserved for the Court whether the knowledge of the untruth was material.

Habits.—Again, a person may be labouring under no actual disease at the time of effecting the insurance, but his *habits* may be such as to produce general injury to health, and to have a tendency to shorten life. Concealment of habits, the effect of which on health must or ought to be known to all medical men, may be just as fatal to a policy as the concealment of a serious disease. Although they may not always be included in the questions put by the Office, yet the law will equitably hold that the insurers should be made acquainted with all circumstances which might reasonably affect the risk. Concealed habits of drunkenness have thus given rise to medical questions of considerable importance; and in one remarkable instance which will be mentioned hereafter, a question arose as to whether the practice of opium-eating, which had been concealed from the insurers, had or had not a tendency to shorten life.

Some recent exposures, partly of a civil and partly of a criminal nature, have rendered Insurance Offices much more strict in their inquiries. In the rules already quoted, special information is demanded upon the existence of material circumstances touching health or habits of life, and whether the person is or is not of temperate habits. Any facts bearing upon these questions, if known to the medical attendant, must of course be stated. The existence of such habits must be known to the person himself; and the declaration which he signs is so explicit that, if intentionally concealed by him, no individual can reasonably complain of the voidance of the policy and the forfeiture of the premiums.

The case of *Von Lindenau* v. *Desborough*, tried in the Court of King's Bench before Lord Tenterden in October 1828, shows that medical men are bound, at the risk of invalidating the policy, to state the exact bodily condition, so far as it can be obtained by observation, of the person whose life it is proposed to insure. It appears that on the 16th June 1824, a policy for 3,208*l.* was effected, in the Atlas Office, on the life of the Duke of Saxe Gotha, at the time he was residing abroad. The Duke died on the 11th February 1825, within nine months of the time of effecting the insurance; and the payment of the amount of the policy was refused on account of a material concealment of the exact condition of the insured from the insurers. It appeared in evidence that for some time prior to the insurance, the Duke had been an invalid, and that at the time it was effected he was childish and had not spoken for two years.

He had laboured under some affection of the brain, did not improve in health after the insurance, and ultimately died from an attack of paralysis. The certificate upon which the insurance was granted had been signed by two German physicians, Drs. Dorl and Ziegler. It was to the effect that the general health of the Duke was good; but that he was 'hindered' (gehindert, had an impediment) in his speech, and had an affection in his left eye. It was also stated that he was perfectly free from disease or symptoms of disease. On inspection of the head a tumour of large size connected with the inner table of the skull was found pressing upon the brain. This tumour was evidently of long standing, and had probably been the cause of the symptoms and death. Ten ounces of serum were found effused in the brain.

It appears that before the insurance was effected an agent in Germany had informed the insurers that the Duke had led a dissolute life, by which he had lost the use of his speech, and, according to some, of his mental faculties also; and on this the Office required a payment of nearly double the usual premium. The case of the insurers was that there had been material concealment of the Duke's real condition at the time of effecting the insurance. The late Mr. J. H. Green, who appeared as a witness for the plaintiff, the claimant under the policy, considered, from the history of the case, that there were no symptoms of organic disease, although the symptoms mentioned would lead to a suspicion of disease in the head. In reply to a question by Lord Tenterden, he said if, as a medical man, he had been asked by an Insurance Company concerning the state of a man's health, who was unwilling to move, who was subject to control and influence, and who had lost his speech, he would have considered it his duty to mention these circumstances. Lord Tenterden then left it to the jury whether there had been any concealment of material facts relative to the Duke's health. The plaintiff was nonsuited, and a new trial subsequently refused.

There can be no doubt that the answer here given by Mr. Green was such as every conscientious man must have given under the circumstances. A medical expert appears in Court to speak the *whole truth*, to the best of his judgment, and not to make out rightly or wrongly the particular case of the person who summons him. On the other hand, it is obvious that Drs. Dorl and Ziegler gave a most improper certificate. They might not have been able to express any opinion respecting the existence of a tumour in the brain, but they were wrong in suppressing the real state of the Duke. If they knew his actual condition, their conduct was censurable; if they did not know it, they were not justified in signing a certificate at all. Because a man may enjoy at the time tolerable bodily health, facts of this nature, showing great disease of the nervous system, ought not to be kept from the knowledge of the insurers. Imbecility depending on whatever cause should always be mentioned.

Material concealment.—Some medical practitioners entertain the opinion that, provided they can certify that the person is in good health at or about the time of the insurance, this is all that the insurers need know. The same opinion is commonly entertained by the insured; and the latter, after having been attended by one medical man for an illness, will apply to another, a comparative stranger, to certify to his condition of health for insurance. We must not lend ourselves to this system, which is based sometimes upon a mistake, at others upon fraud. If medical men would decline signing the papers under such circumstances, they would not only save themselves from censure, but be actually conferring a benefit upon the applicant, by preventing him from obtaining a policy upon terms which on his death may render it invalid, and entail a forfeiture of the premiums. From what has already been said, it will be understood that the exact state of health of the person at the time of the insurance does not represent the whole of the risk incurred by the Office. The restoration to health, as in a case of diseased lungs, may be only temporary: it may be speedily followed by phthisis, and the insurers therefore ought to be informed of the previous condition as well as present state of the applicant. The conditions in the declaration are so explicit upon this point, as to render it scarcely necessary to refer to the propriety of making this addition to the certificate. The disease under which the insured had laboured may have been of a trivial kind, and not likely to affect the risk; nevertheless the safest plan is to state it. The option will then lie with those who are to incur the risk. When facts of this kind are either concealed or not plainly stated, the question of how far they were or were not material to be laid before the insurers is always left to the jury, who are guided in their verdict by their own common-sense as well as by medical opinions. It would appear also, from a decision of the House of Lords in *Anderson* v. *Fitzgerald*, that the truth of the answers given and not their materiality, should govern the verdict of a jury. In a case tried in December 1856, Lord Campbell held that a suppression of the truth on the part of the person whose life was insured would not avoid the policy, if the party effecting the insurance was innocent and ignorant of the suppression.

Some medical men have adopted the plan of signing certificates, but have declined to make any written reply to certain queries: as, for instance, the general query—Can you give any and what information respecting the *habits* of the applicant? If nothing be known concerning these, it should be so stated; if, however, the existence of any habits affecting health be known to us, we shall do an injury to the applicant and ourselves by withholding information on the subject. It may be the means of causing a heavier premium to be demanded for insurance than if the facts were known; and if this should not happen, the omission is very likely to give rise to future litigation. Thus, in the case of the *Earl of Mar*, the payment of the policy was refused on the ground that the Earl had been addicted to opium-eating. His medical referee replied favourably to the *special* questions in regard to habits, whether sedentary or active, temperate or intemperate; but he neglected to reply to the *general* question regarding habits; and on the Earl's death it was found that he had been an opium-eater for many years before effecting the insurance. This fact might not have been known to the medical referee, but it is always better to fill in the reply either affirmatively or negatively, if the certificate be signed at all, than to leave the Office to draw an unfavourable inference, or to render the policy afterwards open to dispute.

In the case of a *Mrs. Elgie* payment of the amount of a policy was refused under the following circumstances:—The insured had been for some time prior to the insurance in a delicate state of health, and in the year 1821 it was thought that the symptoms were those of *phthisis*. In October 1822 she was twice alarmingly ill. In December of that year, wishing to insure her life, she called in a medical friend, who had not been in attendance upon her, to examine her and certify as to her state of health. It appears he examined particularly the state of her lungs and liver, and finding them, as he thought, sound, certified that the ordinary state of her health was good. On the 19th March 1823, he gave another certificate to the same effect, upon which the insurance was effected in April 1823. Mrs. Elgie died of disease of the lungs in April 1824. Payment was refused, on the ground that there had been concealment of material facts as to the state of health of the insured. It appears that, unknown to the medical gentleman who had given the certificate, the insured had been attended between December 1822 and the 19th March 1823 (the date of the certificate) by a medical practitioner residing in her neighbourhood for a cough, and that she had become much emaciated. This gentleman, however, thought that there was no structural disease—an opinion confirmed by the examination made for the certificate in March. The fact of the deceased having laboured under this illness was, however, concealed from the insurers. The jury thought that, although there had been concealment, it was not material, and a verdict was returned against the defendants. A new trial was granted, but a verdict was again returned against them. The truth is, it is not the concealment of every slight attack of illness that will vitiate a policy; although the contract being one, as it is termed, *uberrimæ fidei*, it is in the highest degree unwise either in the insured, or, if it be known to him, in the medical man signing the certificate, to conceal from the insurers any previous illness or medical attendance from another quarter. It may always be fairly urged that a knowledge of the facts might have led to the rejection of the life, or have made a difference in the amount of the annual premiums. One part of our duty therefore, if we sign a certificate upon a careful examination, is to ascertain whether the applicant has or has not been previously attended by another medical practitioner.

A case was tried at the Warwick Summer Assizes, 1844 (*Geach* v. *Ingall*), in which it was alleged that the existence of *phthisis* (pulmonary consumption), or phthisical symptoms, had been concealed from the Office. On the side of the plaintiff the medical attendant of the insured was called, and he certified that in May 1840, when the policy was issued, he considered the deceased to be in good health, and an insurable life. A physician who examined the deceased in February of that year stated his belief that the chest of the deceased was sound, and he considered him to be a very good life. For the defence two medical men were called, who deposed that deceased had had spitting of blood before effecting the insurance, and that he had laboured under decided symptoms of consumption in 1840, which it was inferred must have existed at the time of the insurance. There was evidence of a general consumptive tendency in the family; the father died of it, and there was no doubt whatever that the insured had died of it in December 1843, three and-a-half years after the policy was issued. The medical evidence was conflicting, but the existence of the disease at the time of the insurance rested upon presumption and not upon proof; hence the jury returned a verdict for the plaintiff. A second and a third trial were had upon this case, on the ground of misdirection by the learned judges; but verdicts were again returned on both of these occasions in the plaintiff's favour. It is most probable that the seeds of consumption existed in the insured; but, unless there is some plain and certain evidence from symptoms, proof of this will amount to nothing. If inferential proof of this kind were sufficient to avoid a policy, the payment of most policies might be easily and successfully disputed. Had the deceased died soon after the insurance, there might have been greater probability in favour of the view adopted by the Office; but he lived nearly four years afterwards; hence, if the symptoms had existed in a confirmed state at the time of the insurance, of which there was no direct evidence, as the medical officer of the Company had certified in favour of the life, the case must have been of an unusually protracted kind.

In a case in which *strangulated hernia* was the cause of death, the deceased had insured his life upon his own declaration and a medical certificate. In about thirteen months afterwards he died from the effects of an operation for strangulated hernia. The medical witness who signed the certificate stated at the trial that the deceased had never had hernia, and that he had not attended him for that disease. A letter was produced, however, in which he (the witness) had admitted the existence of hernia in the deceased four months before his death. He denied the truth of this statement, and said the tumour which he had reduced by manipulation was varicocele. The question was, whether hernia had or had not existed, and had been concealed from the insurers at the time when the insurance was effected. The admission in the letter carried the period of the alleged existence of hernia to five months after the certificate was granted, whilst the deceased had positively stated in his declaration, that he was not and had never been affected with rupture, and the medical certificate was to the same effect. One medical witness deposed that he had been consulted by the deceased, and had found him labouring under irreducible hernia five months before he proposed to insure his life! This gentleman stated that he then informed the deceased he had inguinal hernia: he tried to reduce it, but could not succeed. These facts, it was alleged, were not stated to the insurers at the time of the insurance, as they certainly ought to have been. On the other side, two medical witnesses, including the operator, thought that the hernia was quite recent. The operator found no adhesions, and there was nothing to induce him to suppose that the hernia was of fourteen months' standing. Evidence was also given to show that the witness who deposed to the existence of inguinal hernia before the insurance might have been mistaken in his diagnosis, and have confounded a hydrocele or a varicocele with a hernia; but admitting this to be true, the existence of a tumour of any kind in such a situation should not have been kept concealed from the Company or their medical referee. The jury returned a verdict that there was no fraud, but that the deceased had had hernia at the time of effecting the insurance. A second trial was granted, and a verdict was then returned in favour of the plaintiffs.

If, under any circumstances, a jury should find that the concealment is material, the legal consequence is that the policy is void. It is not at all necessary that the person should die of the disease concealed. This rule was laid down by the late Lord Tenterden in the case of a *Colonel Lyon.* The Colonel insured his life by two policies in May and June 1823, and died of a bilious remittent fever in October of that year. Payment was refused on the ground of misrepresentation and concealment. Colonel Lyon referred the Office for a certificate of his health to a gentleman who had not attended him for three years previously. His answers to the printed questions were that he had had no other medical attendant, and that he had never had 'a serious illness.' The medical gentleman to whom he referred certified that his life was insurable, and the policy was issued. It appeared in evidence, however, that the deceased had been attended by two other medical practitioners from February to April 1823 for hepatitis, fever, and a determination of blood to the head. One of these employed very active treatment: he considered him to be in a dangerous state, and would not have certified him to be in health until the end of May 1823. All agreed that the deceased did not die of the disease for which he had been thus attended. Lord Tenterden stated it to be his opinion, that if a man referred to one practitioner, because he could speak well of his health, and thought that if he referred to other medical men because they would not so certify, although the insured did not die of the disease with which he was then afflicted, the policy would be void. A verdict was accordingly given for the defendants. The practice of referring to medical men who have been only recently consulted is not unfrequent. The opinion of the usual medical attendant might be unfavourable, or he might report on the existence of habits which would render the life uninsurable, or insurable only at a high premium. This want of fair-dealing, however, commonly defeats its object. There is expensive litigation, and the policy is pronounced to be void. The case of *Wilshere* v. *Brown*, tried before Lord Abinger in the Exchequer in December 1842, and of *Palmer and Fish* v. *Irving*, tried at the Norwich Summer Assizes, furnish illustrations of this. In the latter case the deceased had returned that he had never had a medical attendant. His life was insured for a large sum on the 21st November 1842, and he died on the 5th December following. There was reason to believe that he had died from inflammation of the lungs; but it was proved that he had laboured under symptoms of pulmonary consumption, and had been attended by three medical men shortly before he effected the insurance. This was concealed, and the policy was set aside on the ground of fraud.

A singular case was tried at Glasgow in 1837, in which the proceedings were inverted, compared with the usual English practice in such cases. An Insurance Company brought an action against the representatives of the insured, on the issue whether the policy had not been obtained by misrepresentation and undue concealment. An insurance was effected on the life of a *Mrs. Ralston*, on the 10th December 1833. Her own declaration was that she was in good health, and that she was not afflicted with any disease or disorder tending to shorten life. She referred to her usual medical attendant, who certified that he had known her for ten years, and had been in the habit of attending her professionally; that she was last ill in the month of September 1833; 'that her indisposition was acidity of the stomach;' that she had not, to his knowledge, been affected with any illness of such a nature as to influence her general health; that she was then (30th November 1833) in perfect health, and was not subject to fits or any affection of the head, but occasionally to slight headache from acidity in the stomach. He knew of no circumstance in her business or habits of living tending to impair her health or shorten her life. The deceased died of apoplexy on the 3rd September 1834, within nine months from the issuing of the policy. The Insurance Company were about to pay the amount, when an action was brought by the medical attendant against the executors of the deceased for payment of 162*l.* for medical attendance, &c. on Mrs. Ralston, from the 15th September 1833 (two months prior to the date of the policy) to the 4th June 1834. The referees awarded 145*l.* to the plaintiff. His books were given in evidence, and it then appeared that between the 19th September and 3rd December 1833 (the date of the proposal for insurance) he had paid her thirty-five professional visits, most of these of long duration. It further appeared from the diary that she had been frequently bled—her head had been shaved and blistered, and leeches had been applied to her temples. She had also had constant attendance after the insurance, and in the early part of 1834 had had several fits of epilepsy. Three medical witnesses deposed that the declaration of deceased and the certificates given by her medical attendant did not set forth her true condition; and that there had been misrepresentation and concealment of material facts. This was also the opinion of the judge, and a verdict was returned for the Office. Although the illness, prior to the insurance, might have had no connection with the death from apoplexy, it was held that the insurers ought to have been made acquainted with it.

Among the diseases upon the concealment of which policies have been most frequently disputed, may be enumerated gout, dropsy, paralysis, epilepsy, hæmoptysis, incipient phthisis, delirium tremens: and to this list may be added drunkenness, intemperance, and irregular habits.

Intemperate habits.—In a large number of cases the payment of policies is resisted on the ground of concealed drunkenness and general habits of intemperance. There is some difficulty in these cases, because medical men may entertain different opinions respecting the effect of such habits upon the general health, and the degree to which they may be safely carried. There is one thing however certain—whatever may be our opinion of their effect on health, we are bound to state, if known to us, that they exist, and thus put it out of the power of a Company to dispute a policy upon such a ground. From the frequent concealment of habits of this kind, some Offices now adopt the practice of making it a special question, to which a plain negative or affirmative answer should always be given — 'Are you now and have you always been of temperate habits of life?'

When intemperance is alleged, we find not only conflicting medical evidence but much cross-swearing among the witnesses. It becomes a question — What is intemperance? and this is answered according to the peculiar views of a witness. A case was tried at the Exeter Spring Assizes in 1842 (*Southcomb* v. *Merriman*), which will show the difficulty of getting at the truth. Payment of a policy was disputed by the Office on the ground of concealed intemperate habits. At the trial the representatives of the insured called twelve witnesses to prove that the deceased was a very temperate man, while the office called twenty-one to show that he was habitually intemperate! One of the temperance witnesses (for the plaintiff) defined drunkenness to be 'when a man lost his reason, could not give a proper answer, was not able to do business, had lost his legs, and was obliged to be carried home.' He admitted that the deceased had occasionally continued drinking for three or four days together, but that was a very rare occurrence. The medical attendant who gave the certificate said that the deceased's was a perfectly good life, and he considered him to be a person of sober and temperate habits: he had not thought it requisite to inform the Office of occasional outbreaks, because he did not think that drinking had any effect upon his health. Several witnesses proved that deceased was in the habit of drinking enormous quantities of beer, and that it required a great deal to make him ramble. The insurance was effected in October 1839, and the deceased died in April 1841, from inflammation of the lungs; but, in the opinion of the medical witnesses, this had not arisen from excessive drinking. Notwithstanding the concealment of these facts, the jury returned a verdict for the full amount claimed; but a rule for a new trial was afterwards obtained. This case shows what fallacious views are entertained on the medical questions of life-insurance. In a case like this it was clearly the duty of a medical man to describe the habits of the deceased. He might, if he pleased, have appended to the certificate that in his judgment they had not affected the health of the person, but the defendants who were to take the risk should have been placed in a position to form a judgment for themselves.

In the case of the Hon. H. G. Talbot (*Craig* v. *Fenn*, December 1841), where no answer was returned to the question whether the deceased was of temperate and moderate habits of life, and the Company actually charged a higher premium in consequence, the jury returned a verdict in their favour, the real condition of the insured not having been made known to them at the time the insurance was effected.

Delirium tremens. Concealed habits of intemperance.—In *Hutton* v. *Waterloo Life Association* (Q.B. December 1859), an action was brought by a widow for the recovery of 2,500*l.* upon a policy effected in April 1854 on the life of her husband. Payment was refused on the ground that the written answers made by deceased to questions proposed by the Company were false, and therefore that the contract which was based upon them was void. One question was whether he was subject to *delirium tremens* or any disease calculated to shorten life, which he answered in the negative; a second was, whether he was of temperate and sober habits, which he answered in the affirmative; and a third was as to the name and residence of his 'ordinary medical attendant, to be referred to as to present and general state of health,' to which he answered, 'Dr. Cobb.' The inquiry now was whether these answers were true. The action had already been once tried, when the plaintiff obtained a verdict; but the Court granted a new trial upon the ground that there was no finding by the jury.

The evidence in the case, medical and general, showed that deceased was of intemperate habits, and that in May 1854 he had suffered from delirium tremens, of which disease he died in 1856; further, that Dr. Cobb, to whom he referred as his usual medical attendant, had not attended him since 1851, and that from this date until the date of the insurance he had been attended by another medical man, to whom he had given no reference, although he was his usual medical attendant. The jury found for the defendants on the main issues. This case presented two curious features:—1st, the medical evidence proved that the first attack of delirium tremens came on on May 11, after the insurance had been effected; and 2ndly, the medical attendant of the deceased and the medical officer of the Company differed greatly about the deceased's state of health at or about the time the insurance was effected. The medical attendant of the deceased, who was a witness for the Company, deposed that he attended him for an attack of delirium tremens on May 11, and again on May 28, 1854—both attacks being the results of excessive drinking. The report to the Company, made by their own medical officer, dated May 22, 1854, gave however a most flattering account of deceased's health, and described him as a 'first-class life.' In his evidence at the trial this gentleman said that he then observed no indication of delirium tremens nor of drunken habits; the deceased was the picture of health. This serious discrepancy could not be reconciled by a re-examination of the witnesses. The concealment of intemperate habits was clearly proved, and on this probably the verdict of the jury chiefly turned.

Questions of a similar kind were raised in *Wheelton* v. *Hurdisty* (Q.B. Dec. 1856). An insurance had been effected to a large amount on the life of a Mr. Jodrell, and the payment of the policy was disputed on the ground that there had been concealment of intemperate habits, and of the existence of delirium tremens at the time the insurance was effected. The jury found that there had been misrepresentation and concealment.

One of the most singular cases of this description, in reference to conflicting medical evidence, was that of *Rawlings* v. *Desborough*, tried by Lord Denman in December 1837. The main question was, whether a Mr. John Cochrane, whose life had been insured, was or was not a person of intemperate habits at or before the time of insurance. A medical certificate had been given to the effect that his habits were not intemperate. The weight of the evidence, however, general and medical, tended to show that he was a thorough drunkard. One of the witnesses for the plaintiff said, the deceased 'never appeared to me to take anything to hurt a man; I never saw him drink more than the rest of the company; I only saw him intoxicated fifty or sixty times in four years! His health did not seem to be impaired by what he drank.' His groom stated that he had seen his master 'tipsy a hundred times perhaps, but not beastly drunk.' The late Mr. Travers examined the deceased for one Office, and, from what he saw, advised that his life should not be accepted. He considered the man to be labouring under *delirium tremens*. One observation made by this witness is worthy of remembrance when a medical practitioner is engaged in examining a person for a life-insurance—i.e., a man may have pursued an intemperate course for some time, and yet his appearance at the time may be such as to lead a common observer to imagine he was in the plenitude of health when he is liable to become the subject of an immediate attack. Notwithstanding the strong evidence of habits of intemperance from a period anterior to the date of the insurance, the jury returned a verdict for the plaintiffs, but a motion for a new trial was soon afterwards made. Lord Denman observed upon this occasion, in respect to what was *material concealment*, that he did not conceive the true meaning to be, that the party whose life was to be insured was bound to volunteer a statement of every circumstance that anybody might afterwards think was likely to affect the risk of his life. The real intention was, that he should submit himself to a full examination and inquiry, that he is bound to state nothing untruly, and that he is bound to answer all questions truly. If he decline to answer, the Office may act upon his refusal, and if he answer untruly, he shall gain no benefit from such false statement.

In February 1840 a trial took place before Tindal, C. J. (*Pole* v. *Rogers*) relative to a policy on the life of Mr. Peter Cochrane, brother of this Mr. John Cochrane. The insurance was effected in 1834. The insured died the following year of *hydrothorax*, brought on, as it was alleged by defendants, by very intemperate habits, the existence of which was concealed from them. The evidence, both medical and general, was just as conflicting as in the former case, and it became rather a question of credibility. The jury returned a verdict for the plaintiffs, thereby either denying the existence of intemperance, or considering that the concealment of it if it existed, was not material.

This case is worthy of note in one point of view, as it involved a new question in medical jurisprudence — namely, whether, we are to regard the *immediate* or *remote* effects on the body produced by intemperate habits? The Solicitor-General, who appeared for the plaintiffs (the representatives of the insured), argued that the terms 'habits prejudicial to health' were too indefinite. Was it to be regarded as an abstract or relative proposition? He appeared to rest his case upon an admission that there was intemperance to a certain degree, but he contended that habits which were not at all prejudicial to the health of one man might absolutely kill another. There was a very common habit of keeping late hours; this might be utterly destructive to the health of some persons, but not to that of others. This sort of condition was so vague that it left it open to an Insurance Office to resist the payment of any policy, unless the meaning of the words was brought within some reasonable and well-defined limits. The jury were bound to see whether the alleged intemperate habits had been indulged in for a long time without injury; they must look to all the habits of the person taken together, and see whether one habit was not counteracted in its effects by another. The insured was a man of very active habits, and therefore excessive drinking would not affect him as it would others who led a sedentary life.

This ingenious but sophistical reasoning involves an important medical question. It is well known that intemperance is a relative term, and may be differently construed by different medical witnesses.. The real question, however, divested of its sophistry, is this :—Can any person indulge in an excessive use of alcoholic liquids without this practice sooner or later leading to an impairment of health, by producing disorder of the stomach and liver, and remotely affecting different organs ? The effects of such habits may not show themselves immediately, but the Office requires to be informed of their existence or nonexistence, and not of the period when they are likely to affect health visibly or to engender a fatal disease. To assert that a man can be addicted to excessive drinking without impairing his health is contrary to all experience. There is no such compensation or balance of habits as that which the Solicitor-General supposed to exist in this case. Habit may accustom a man to intemperance—it may enable him to drink a large quantity of alcoholic liquid without being apparently injuriously influenced by it at the time; but a deranged state of system will sooner or later follow, and delirium tremens or dropsy will probably supervene. A good natural constitution may enable a man to resist the pernicious effects for a certain period, but ultimately they will show themselves in some form of disease; and in the case of these two brothers, the result of their intemperance was made apparent in the very early deaths of both. It is unfortunate that no light is permitted to be thrown on such cases by pathology. Post-mortem examinations are not always made in these cases; for the death being, as it is called, natural, it is not commonly thought necessary to inspect the body, although, as in the above instances, the condition of the liver and other organs might at once have removed a difficulty which arose from the conflicting evidence on the habits of the deceased.

In all cases of a contested policy, one important principle is uniformly acted upon; those who resist the payment are bound to prove what they allege by conclusive and satisfactory evidence. A Court will not receive probability or conjecture—the evidence must be certain. Hence many suits fail from the medical evidence going no further than to show that a particular disease or habit had *probably* existed at the time of insurance. If the disease or habits be shown to have *certainly* existed, the evidence may still fail to prove satisfactorily that the concealment was either wilful or material.

Contested cases of life-insurance are very instructive: they often show the imperfect manner in which medical observations respecting health or disease are made, and that the medical treatment of persons whose lives are insured may become a material question in the event of a policy being disputed. In the case of *Chattock* v. *Shawe*, in reference to an insurance on the life of a Colonel Greswold, a question arose not only respecting the concealment of intemperate habits, but as to the concealed existence of delirium tremens, from the examination of handwriting, as well as from the description given by non-professional witnesses. It was here even doubtful what had caused the death of the deceased. According to one medical witness, it was a curious combination of Asiatic cholera, phrĕnitis, and epilepsy! It was proved that, more than three years before the insurance was effected, this gentleman had met with a fall, and he was afterwards seized with a fit, described by some witnesses as epileptic, by others as arising from concussion of the brain. The existence of intemperance and epilepsy prior to the insurance was not made out to the satisfaction of the jury, and they returned a verdict for the representatives of the insured.

In *Walters* v. *Barker*, tried at the Monmouth Summer Assizes, 1844, the deceased, at the age of sixty, insured his life on the 4th May 1841, and he died in the August following. It was alleged by the Office that the cause of death was an attack of *paralysis*, which it was pretended had existed from a very early period of his life. No medical evidence was given on either side; there was merely a presumption that death might have taken place from paralysis; hence the verdict was for the plaintiffs.

Abstinence. The Vegetarian System.—We have already considered the effects of habits of intemperance, and the necessity for stating in a certificate the existence of them when known; but other habits may exist which have a tendency to shorten life, although in a less obvious manner. What are called *temperance* principles are or were very prevalent. There are many persons who have been full livers, and have afterwards taken up the notion that water and a vegetable diet were all that was necessary to support life. This sudden change, especially in persons advanced in life, is very likely to affect the constitution seriously, and, if not to create disease, so to weaken the vital powers as to render any slight illness or accident serious. I knew one instance in which a gentleman who had been in the habit of living on a full diet, with a moderate use of alcoholic liquids, suddenly adopted the plan of living on water and vegetable food; he obviously fell off in strength, and lost his previously healthy condition. About a year afterwards he met with a slight sprain to the ankle-joint; inflammation ensued, which, in spite of the best treatment, assumed an unhealthy character; suppuration of the joint followed; amputation of the leg was performed, but, in spite of an improved diet, the powers of life never rallied. There was no attempt at union in the flap, and he finally died exhausted. There can be no doubt that these sudden changes in the mode of living are liable to lead to impairment of health, and to affect materially the expectation of life. Hence it is our duty to inquire and report upon facts of this kind when they become known to us.

In Huntley v. *The St. George Insurance Company* (Newcastle Autumn Assizes, 1858), a medical man insured his life for 2,000*l.*; and although certified to be in good health, and to all appearance he was so, he died from Bright's disease within three months after he had effected the insurance. There was also disease of the heart. The questions whether he had either of these diseases at the time of the insurance were answered by him in the negative. It was contended that, as a medical man, he must have known that he was suffering from these diseases, and had wilfully concealed them. It appeared from the evidence that the deceased had taken to a vegetable diet, and it was considered that this was the cause of the rapid failing of his health. The jury returned a verdict for the plaintiffs, and the Chief Baron suggested that in future, Insurance Companies should put among their questions to insurers, 'Are you a vegetarian?'

Opium-eating.—There is another habit said to be common, the concealment of which gave rise to an important trial some years since: I allude to the practice of *opium-eating.* In 1826 the *Earl of Mar* effected an insurance on his life, and two years afterwards, i. e. in 1828, he died of jaundice and dropsy at the age of fifty-seven. The Insurance Company declined paying the amount of the policy, on the ground that the Earl was, at the time of the insurance, and had been for some time previously, an opium-eater. This practice was concealed from the insurers; and it was further alleged that it had a tendency to shorten life. It was clearly proved in evidence that the Earl had been a confirmed opium-eater up to the time of his death. According to Dr. Christison, the deceased had taken laudanum for thirty years, at times to the amount of two or three ounces daily—a tablespoonful for a dose. He was a martyr to rheumatism, and, besides, lived rather freely. Many persons who were constantly about him, and many intimate friends, deposed that until 1826 (the year of the insurance) he was of a cheerful disposition, and clear in his intellects. Some of them admitted that they then perceived a change in his habits, which they attributed to the adverse circumstances in which he was compelled to live. In 1825 Dr. Abercrombie found him enfeebled and broken-down in constitution, but without any definite complaint. The main question at the trial was, whether opium-eating had a tendency to shorten life—for on this the issue turned—whether the concealment from or the non-communication of this practice to the Office was or was not material.

Drs. Christison, Alison, Abercrombie, and Duncan were examined on the part of the insurers; and although they entertained the opinion that the habit had a tendency to shorten life, they were unable to adduce any cases in support of it. Their opinion was based not on personal experience, but on the general effects of opium, as manifested by its action on the brain—by its producing disorder of the digestive organs, and giving to the person a worn and emaciated appearance. In most of the instances collected, there was no evidence that life had been shortened by the practice. On the contrary, some of the individuals had carried it on for years, and had attained a good old age. The jury returned a verdict for the plaintiffs, not on the ground that the practice was innoxious and its concealment immaterial, so much as on the technical point that the insurers had not made the usual and careful inquiries into the habits of the deceased; and they were therefore considered as having taken upon themselves the risk from their own *lâches*. It appears that the general question with respect to habits was not answered by the medical referee, and it was therefore considered that the Office had waived the knowledge of them. A new trial was granted, on the ground of misdirection, but the suit was compromised.

Hence it will be seen that no decision was come to in this case on an important question, which is very likely to arise again. It will be desirable therefore to examine some of the facts connected with opium-eating, in order if possible to see how far it really tends to shorten life. In the case of the Earl of Mar, it appeared to be a fair inference that the habit did not shorten his life, for he is represented to have indulged in it for thirty years; and for twenty-eight years, according to the statements of his friends, no injurious effects had followed. Dr. Christison subsequently collected from numerous sources no fewer than twenty-five cases, from which we learn that opium has been taken in large quantities for forty years together without producing any marked injury to health. At the London Medical Society, the late Dr. Clutterbuck related the case of a woman who for seven years had taken two scruples (forty grains) of solid opium daily. She was fifty-four, had led an irregular life, and had first taken opium to relieve the pains of rheumatism. The dose was not increased, and the usual ill-effects of opium were absent—such as constipation, nausea, and loss of appetite. Although she did not increase the dose, the effects of the diminution of a single grain of her usual quantity were most marked, and she felt them immediately. Many cases of this description are recorded by medical authorities; they appear to show that opium-eating has not necessarily that tendency to shorten life which it has hitherto been supposed to have. There is, however, sufficient evidence to prove that the practice gives rise to prejudicial effects on the system and tends to impair health. It may not have this effect in all cases, except on the withdrawal of the stimulus; but this is not the question. It might be on this principle argued that the drinking of alcoholic liquids has no tendency to shorten life, because some hundreds of cases may be adduced in which the persons have been addicted to intemperate habits for years, and have still appeared to suffer but little in bodily health. They who have witnessed the effects of opium-eating in Turkey and China agree that the practice leads to the speedy destruction of health. Dr. Oppenheim, in writing on the state of medicine in Turkey, says: 'The habitual opium-eater is readily recognized by his appearance. A total attenuation of body, a withered yellow countenance, a lame gait, a bending of the spine (frequently to such a degree as to cause the body to assume a semicircular form), and glassy deep sunken eyes, betray him at the first glance. The digestive organs are much deranged; the sufferer eats scarcely anything, and has hardly one evacuation in a week; his mental and bodily powers are destroyed. As the habit becomes more confirmed, his strength continues decreasing, the craving for the stimulus becomes greater, and in order to produce the desired effect the dose must be constantly augmented. After long indulgence, the opium-eater suffers from neuralgic pains, to which opium itself brings no relief. These persons seldom attain the age of forty if they have begun to take opium early.' This description of the effects is exactly what we should expect from physiological and pathological reasoning. Dr. Christison states he has ascertained that constipation is by no means a general consequence of the continued use of opium; but this may be simply an exception to the rule. It is believed by some that the action of the drug may be different in different countries, and that the description of the effects produced by the use of opium in Turkey cannot be applied to the English opium-eater. The following case however, which occurred to Dr. A. T. Thomson at University College Hospital, shows that climate has little influence on the effects of this drug:—

E. M., aged 35, was admitted May 26, 1835. About seventeen years ago she began to suffer from a pain in the right iliac region, for which a medical gentleman ordered her to take ten drops of laudanum night and morning. This was gradually increased, the pain continuing, until at last she took three teaspoonfuls every four hours, night and day. At first the ten drops relieved the pain, but it was found necessary to increase the dose to produce the same effect, so that the three teaspoonfuls at last did not produce so much relief as the ten drops at first. The effect of the small doses was simply to produce a relief from pain, without otherwise affecting the body or mind. As the dose was increased, however, she found it to produce a comfortable condition of the mind: she felt lively and cheerful, and was capable of doing any amount of work; it also caused a sense of warmth over the whole body. She had severe family afflictions, but while under the influence of opium was not at all distressed by them, although she felt them severely at other times. If she passed over the usual time for taking a dose, she had the most distressing sensations about the joints, not of pain, but such as she was unable to describe. She suffered from involuntary motions of the arms, fingers, and toes; numbness in the limbs and body generally; profuse perspiration, nausea, vomiting, and loss of appetite; a saline taste in the saliva, and a bad taste in the mouth; trembling of the limbs, great debility, and a feeling of lassitude. The memory and mental powers generally became impaired, and there was a great depression of the spirits. These symptoms were all relieved by a repetition of the dose. The opium also produced constipation—not more than one motion occurring in a week; and she does not recollect whether that was produced by medicine or not. If the dose was deferred, she had always suffered from severe headache. Her sense of smell was so much impaired that she could perceive no pungency in snuff; her taste was so much lost that she could not distinguish pepper or mustard; and her hearing was so defective that she could hardly detect the voice of anyone who spoke; yet her own voice sounded most disagreeably loud to her. Her touch was so much affected that she could not execute any needlework. The acuteness of all her senses was however, restored by the usual dose, the want of which was indicated by flushing and heat of the face. During the period of taking the opium she had very little sleep, and in the intervals she did not attempt to sleep from want of the desire, so that she generally worked all night. What sleep she had was, generally during the day, but this was much confused and easily broken. About five or six years ago, her resources being exhausted, she obtained admission into the hospital. The laudanum was here discontinued for the first three days, and all the above symptoms were present; she now for the first time appeared to see the most frightful spectres of animals and other objects in the ward. The symptoms were again relieved by the usual doses. The doses of laudanum were decreased during the whole time; and when she left the hospital, she took a teaspoonful only in the course of the day. On returning home, as she was dependent on her friends, she was obliged to discontinue the laudanum and wine, and was unable to get beer; she was now more miserable than before, all the symptoms returning with increased severity, and for the first six months she was almost entirely helpless. There was pain in the chest with a cough, which had continued ever since. She was twelve months at home before the above distressing symptoms disappeared. The consequences of her opium-eating then observed were a much-impaired taste, numbness of the limbs, coldness of the feet, inability to walk far without aching pains in the limbs, and a general sense of lassitude.

There is abundant evidence that this drug, as it has been administered to children in the factory-districts, has produced serious injury to health and great mortality. In the late Mr. Grainger's report on the Children's Employment Commission, it is stated that laudanum and other preparations of opium are given to young children in gradually-increased doses, until the child will bear from fifteen to twenty drops of laudanum at a time. The child becomes pale and wan, with a peculiar sharpness of features, and rapidly wastes away. The majority of these children die by the time they are two years old. These facts appear to show that climate does not at all affect the action of the drug in the early periods of life, and the observations yet made are not sufficiently numerous to justify us in affirming the existence of this influence with respect to adults. Dr. Christison has remarked that many persons probably die young from the effects of this habit without the secret being discovered; for even the medical attendant as well as intimate friends may be kept in complete ignorance of the person indulging in it. On the whole, we are bound to conclude that the habit of opium-eating is injurious to health, and is therefore calculated to shorten life. In any proposal for life-insurance the insurers ought to be informed of this habit where it exists, and no medical man should sanction its concealment merely because many persons addicted to it have lived for years in apparently tolerable health. One of the questions put to a medical man is, whether he knows any material circumstance touching the health or habits of the person to which the other inquiries in the certificate do not extend; and if so, he is required to state them. Now, without going the length of saying that the life of an opium-eater is uninsurable upon a common risk, the habit is itself sufficiently material to require that it should be declared in reply to such a question as this. The practice may be, and often is, concealed from a medical attendant; then the insured, if not candid in avowing its existence, must expose his representatives to the risk of losing all benefit under the policy. Independently of medical facts, which appear to favour both sides of this question, a jury would probably be guided to a verdict by the effect actually produced on the constitution of a person who has been addicted to the practice. If it has continued many years, and there is no proof of his health having in consequence undergone any remarkable change, this might be regarded by the jury as the best possible evidence in favour of the concealment not being in such a case material. The insurers could not equitably complain of the verdict in the Earl of Mar's case; for as he began opium-eating at twenty-seven, and died at fifty-seven without any obviously injurious effects being produced by the use of the drug, it could not be said that in his case at least the practice had shortened life. It is rarely in our power to apply any better or more practical test than this, under circumstances in which medical facts appear to bear both ways. The case is very different from intemperance in the use of alcoholic liquids: no one can doubt that in this form the results must be inevitably to impair health and to shorten life. The facts here bear one way; and if instances of longevity can be adduced among spirit-drinkers, they are well known and generally admitted to be exceptions to the rule. The queries put by Insurance Offices are now so explicit, that they must be considered as including the habit of opium-eating; and there does not appear to be any just pretence for evading the admission of the practice, either on the part of the insured or (if known to him) of his medical attendant.

Tobacco-smoking.—I am not aware that the prevalent habit of smoking tobacco has ever been regarded in relation to life-insurance. Although inveterate smokers are liable to attacks of dyspepsia, loss of muscular and nervous power, weakness, and other derangements of the system, there is not, so far as I know, any evidence to show that the practice has a tendency to shorten life. Should the habit be stated in a certificate? I think it should, if known to the medical referee and where it is of a most inveterate kind. This would at least prevent objections on the part of a captious Company.

There is no rule of law on this point, if we except a dictum of Lord Mansfield: 'The insured need not mention what the insurer ought to know, what he takes upon himself the knowledge of, or what he waives being informed of; the insurer need not be told general topics of speculation.'

Insanity.—When we are called upon to say what *diseases* have a tendency to shorten life, there is commonly no difficulty in giving a reply, since the name of the disease—its known effects upon the body—the degree of mortality produced by it, and its intractableness, are data upon which a medical opinion may be easily expressed. There are some diseases, however, respecting which it is not so easy to return an answer; and among these may be mentioned *insanity*, which has already given rise to discussion in a Court of Law. The treatment of this malady falls out of the usual line of practice; and there are comparatively few in the profession who have made themselves acquainted with statistical details respecting it. This may account for the decision in the following case:—

In 1835, a trial took place at the York Assizes, in which the question was, whether insanity had or had not a tendency to shorten life. The representatives of a clergyman brought an action against the Providence Insurance Company, to recover the amount of a policy effected on the life of a gentleman: but the Office refused to pay on account of the person having been insane, and this fact having been kept from their knowledge when the insurance was effected. Several medical witnesses gave evidence on the occasion. One considered that insanity had a tendency to shorten life; another, that it had not; a third, who admitted that the deceased was labouring under insanity, did not consider that *his* mental state was such as had a tendency to shorten life. The judge charged the jury that the question for them to consider was, whether insanity had a tendency to shorten life, as, if so, this would make the concealment of it material. If insanity had such a tendency, they must find for the defendant; if not, for the plaintiff. The jury found for the plaintiff, on the ground that insanity had no tendency to shorten life, and that therefore the concealment was not material.

There is probably no case which more strongly shows the necessity for proper medical evidence on these occasions. The finding of the jury was contrary to all good medical experience, and was founded on a complete mistake. The researches of Esquirol, Farre, and others, show that insanity has a decided tendency to shorten life. So well aware are the Insurance Offices of this, that the existence or non-existence of insanity or mental derangement is now made a special question, to which an answer must be given in the declaration. The contrary opinion appears to have arisen from the hypothesis that insanity is not a bodily disease, and in no way connected with physical changes in the structure of the brain. Admitting this statement to be true, experience is decidedly against the inference based on it, when we look at insanity in the aggregate of cases.

There was formerly an erroneous notion that insanity had a tendency to prolong life; but more correct statistical researches have shown that the insane are more liable than the sane to various diseases, and that when attacked they sink more easily under them: hence the mortality of the insane is, *cæteris paribus*, much above the average of that of the sane population. Among other fatal diseases, the insane are specially liable to attacks of paralysis and epilepsy: and paralysis, however slight, is commonly the forerunner of death in these cases. In private asylums the mortality is always less than in public hospitals; but recent researches have shown that the mortality of the insane has been much reduced by the introduction of an improved system of management and treatment.

Accurate observations have shown that the mortality among male is greater than among female lunatics, and the more advanced the age the greater the proportionate rate of mortality. The concealment of insanity in any of its forms, or even of a known hereditary tendency to this malady, would be considered material, inasmuch as either condition forms a special question to which an answer should be returned.

Accidental causes of death. Death from sunstroke. — There are several Offices which now insure persons against accidents occurring on sea or land, and it would seem at first sight that there would be less room for litigation under such circumstances. The proof of the accident and the amount of injury done, or (if fatal) the cause of death, would appear to be a simple matter. But the question arises—What is an *accidental* as distinguished from a *natural* cause of death? With our ideas of an accident, we generally associate physical injury or violence done to the person; and if a man dies from any other cause, his death cannot be said to be accidental. This question came before the Court of Queen's Bench in January 1861 (*Sinclair* v. *The Maritime Insurance Company*), and the Lord Chief Justice delivered the judgment of the Court. The action was brought by the administratrix of a person named *Laurence*, who, being about to proceed on a voyage as a master of a vessel, insured himself against any personal injury from any 'accident' which might happen to him upon any ocean, sea, river, or lake. The assured being with his ship in the Cochin River, on the south-west coast of India, and being on duty on board his ship, was, in the language of the special case, 'struck down by sunstroke,' from the effects of which he died in the course of the same day. The question was, whether the death arose from 'accident' within the meaning of the policy, and the opinion of the Court was that it did not. It was difficult to draw a line between a death from 'accident' in a policy of this nature and a death from natural causes, such as should be of universal application. But the Court might safely assume that in an 'accident' some violence, casualty, or *vis major* was necessarily involved, and that a death from a known natural cause could not be considered as accidental. Disease or death engendered by exposure to heat, cold, damp, and the vicissitudes of climate or atmospheric influences, could not properly be said to be accidental; at all events, not unless the exposure was brought about by circumstances of an accidental character. Thus, if a mariner in the ordinary discharge of his duty caught cold and died, his death would not be accidental, though it might be so if by reason of shipwreck he was compelled to take to the boat, and died from exposure to wet and cold. In one sense the death was accidental, for the effect was uncertain beforehand; but it must be considered as the effect of natural causes, and not accidental. Sunstroke, so far as the Court was informed of it, was an inflammatory disease of the brain, brought on by exposure to the intense heat of the sun's rays. To that disease persons exposing themselves to the sun in tropical climates were more or less liable, just as persons exposing themselves to natural causes of a different kind were liable to diseases consequent therefrom. Death from 'sunstroke' must therefore be considered as arising from natural causes and not from accident, and judgment will be given in favour of the defendants.

In the case of a person being killed by lightning whose life was insured against accidental death, the question might arise whether such a mode of death was accidental or not. Death by lightning is certainly not a natural cause of death, and in common language any person killed by lightning is said to have died accidentally.

Suicide.—Among the conditions in policies of insurance, there is generally a stipulation in the contract that the policy shall be void if the person who insures his life commits suicide. Thus, a medical question may arise as to whether suicide was or was not committed in a particular case. A person may die from poison, wounds, drowning, or other forms of asphyxia; and it may be difficult to say in certain cases whether the death arose from accident, suicide, or from violence inflicted by another. Such cases are often left in great uncertainty at coroners' inquests—the evidence received being imperfect or insufficient; because in cases of sudden death, provided there be no suspicion of murder, it is considered of little moment to make a strict inquiry. If the life of the deceased should happen to be insured under a policy containing this condition respecting suicide, the question may become of great moment to the interest of the insurers, and they will require clear evidence that the death was natural or accidental, and not suicidal, before paying the amount of the policy. The cause of death should in all cases of violence be determined by a medical man: this will put an end to any dispute concerning the payment of the policy, and relieve the representatives from the trouble and expense of litigation. If the death be sudden, and any suspicious circumstances are left unexplained, it is certain that a civil action will follow. We are not therefore safe if, at a coroner's inquest, we suppose that we have only to satisfy a common jury by a hasty opinion expressed from an external view of the body or an ill-conducted inspection, merely because it may appear to us quite certain that the deceased could not have been murdered. Should the deceased happen to be one of that class of persons on whose lives insurances are commonly effected, the whole of the circumstances connected with the examination of the body, and the medical opinion of the cause of death, must come to light, and if carelessly performed will probably be made the subject of a severe cross-examination. I have known several instances in which there have been painful exposures of this kind, because the medical witness thought any kind of evidence would serve the purpose of a coroner's jury. The verdict of a jury at an inquest is not binding on a Company: they have not only a right but often good reason to dispute it, and they frequently exercise this privilege. The Insurance Companies are exposed to all kinds of frauds, some of them of a most fearful kind, actually leading, as in the case of burial-clubs (a kind of life-insurance), to the perpetration of murder for the sake of the small amount insured.

A case of some interest in reference to the question of suicide by poison, on the part of a person whose life had been only recently insured for a very large sum, was tried before Lord Tenterden in 1832 (*Kinnear* v. *The Rock Insurance Company*); the late Mr. J. H. Green, Mr. Key, and myself were called upon to give evidence on the part of the defendants. This trial would not have occurred but that the medical inspection of the body for the inquest two years previously had been most improperly conducted, and no satisfactory evidence of the cause of death assigned. As a sum of 10,000*l.* rested upon the issue, the insurers felt that they had a right to demand a full and perfect inquiry. The depositions taken at the inquest on deceased were sent to me for examination, and from these it appeared that the person whose life was insured died two years before the action was brought; the body was carelessly inspected for a coroner's inquest, and the contents of the stomach, without being subjected to any chemical analysis, had been thrown away. These circumstances placed great difficulty in the way of producing proof, and in fact so far as medical evidence was concerned they left the question almost a mere matter of opinion. An application was made to me on the part of the Insurance Company, to know whether the exhumation of the body and any further processes of analysis would be attended with any benefit, but an answer was returned in the negative. From the manner in which the first examination had been conducted—also from the fact that, as the symptoms under which the deceased had died could only have been presumptively those of narcotic poisoning, it was altogether improbable that, after two years' interment, any trace of narcotic poison would be discovered in the remains.

The deceased—who, according to the evidence given at the trial, had been for some time in a low state of mind—returned to his house, in the Regent's Park, on the evening of the 19th October, 1830. The house was then undergoing repair; his family were in the country, and the only person residing with him at the time was a man-servant. The account given by this person was that the deceased returned home about ten o'clock in the evening, apparently in his usual health: he ordered him to place a decanter of wine, a tumbler and a wine-glass on the library-table adjoining his bedroom; told him that he was going to take a composing draught, and desired that he might not be called on the following morning, saying that he would ring his bell if he wanted anything. The deceased went to bed, but about twelve o'clock the servant was awakened by a noise, as if the bar of the library-shutters had fallen. On getting up, he saw his master, without a light, in the act of returning from the library to his bedroom, which adjoined it; he took a light from witness, and again went to bed. On going upstairs ten minutes afterwards, witness found the light extinguished, and the door of the deceased's bedroom fastened. On the next morning, at 9.30, witness went to deceased's bedroom, and knocked at the door as usual, but received no answer; he went again at ten o'clock, but the door was still fastened, and the deceased did not answer when he knocked. The workmen who were employed in the house alarmed witness, about twelve o'clock, by telling him that they had heard his master moaning or groaning. A ladder was then procured, and the room was entered by the window. The deceased was in bed, and appeared to have just died as the witnesses entered. A surgeon was immediately sent for, who on his arrival examined and tasted some liquid which was found in a tumbler on the table. Search was made for a phial, but none could be found; however, it was proved that there were on the library-table a piece of blue and a piece of red paper, evidently the cover and wrapper of a phial, which were not there previously. It was also deposed that a cork and string were found in the fireplace. The window of the library was open, the shutters having been unfastened.

The surgeon, who was called, stated that the body was lying in a composed state, the countenance being somewhat pale. There was perspiration on the skin, with patches of a livid colour here and there distributed over it. The body was inspected for the coroner's inquest by two physicians and two surgeons. An accumulation of putrid blood is said to have been found in the stomach, with an effusion on either side of the chest. The vessels of the brain were somewhat turgid, but there was no extravasation. The contents of the stomach were thrown away without any chemical analysis having been made. It appears that the only approach to analysis was the drawing of a stick of nitrate of silver across the mucous membrane of the stomach at the time of the inspection. The cause of death assigned by these witnesses was the rupture of a blood-vessel in the stomach. A verdict of 'Death from natural causes' was returned; the body was buried, and it was supposed that all inquiry had ceased.

The cause of death assigned by the witnesses being considered altogether inadequate to account for this event under the circumstances—the suddenness of death in a person who was in perfect health the evening before—the absence of any sign of effusion of blood in the brain, so frequently met with in sudden death from apoplexy—together with the circumstantial evidence that some liquid had been taken by deceased and the phial disposed of, afforded a strong ground for suspicion. The insurers refused payment of the amount of the policy and demanded an inquiry.

The circumstantial evidence not being of itself sufficient to establish the fact of poisoning, additional evidence was required to determine—1, Whether the cause of death assigned by the witnesses at the inquest was adequate to account for it; and 2, Whether, if not, the facts proved relative to the death of the deceased were consistent with narcotic poisoning—whether, in short, death by poison was or was not probable.

Mr. Green, Mr. Key, and myself were requested to give an opinion on these points. With regard to the first, we said the cause of death assigned by the witnesses was inadequate and unsatisfactory. The blood found in the stomach was loosely described as half-putrid and not coagulated: so far from its being proved that it had been effused during life, it was not improbable, from the careless manner in which the inspection was made, that it had proceeded from some vessels divided by the examiners. Admitting that it had been effused during life, it did not furnish a satisfactory explanation of the cause of death, since the quantity was small. That it was not satisfactory to the inspectors themselves appeared certain from the fact that they examined the stomach for some kind of poison by the rough experiment of drawing a stick of nitrate of silver over the mucous membrane! Further, gastric hæmorrhage rarely destroys life on a first attack, and is generally accompanied by vomiting of blood; but the deceased had never been subject to hæmatemesis, and there had been no bloody vomiting.

With regard to the second question, the facts proved might be explained by supposing that the deceased had taken a poisonous dose of laudanum or of some preparation of opium: it might be contended that no opiate was present in the stomach, but it did not appear that any analysis had been made. The deceased had died in about the period at which this poison operates fatally; and it was for the jury to determine from the circumstantial evidence, as the medical evidence wholly failed to throw light upon the subject, how far this was likely. We all agreed that narcotic poisoning in the deceased's case was, so far as we could speak in the absence of an analysis, probable, inasmuch as the facts proved respecting his death agreed with this view, and the results of the medical inspection so far as they went were quite consistent with it. On the other hand, the question might arise whether there were no natural causes which would have destroyed life within twelve hours in the same tranquil manner in which the deceased was supposed to have died. To this it may be replied, that apoplexy and other diseases might also have accounted for death; but there was no evidence from the inspection to establish the existence of these, and death from a narcotic poison was, medically speaking, just as probable. In short, as the evidence was essentially of a negative kind, and there were two ways of accounting for death, either of them consistent with the medical facts, it remained for the jury to decide from the whole of the circumstances which was the more probable. The cause of death was entirely a matter of medical presumption. It was impossible to swear that the deceased could not have died from apoplexy or from the effects of a large dose of an opiate. As the case was only one of *suspicion*, and not of actual *proof*, a verdict was returned for the plaintiff.

There can be no doubt of the propriety of the verdict, since the law always justly insists upon what the circumstantial evidence combined with medical opinions was here incapable of affording—namely, *direct* and not inferential *proof* of death from poison. The insurers had alleged suicide by poison—this they were bound to prove by clear and distinct evidence; the plaintiff was not required to show that the death was natural. If, besides the paper-wrappers, string, and cork, a phial which had evidently contained laudanum had been found, or the liquid in the tumbler, instead of being merely tasted or smelt by the medical gentleman and then thrown away, had been carefully nalysed, or had the same cautious proceedings been adopted with regard to the ontents of the stomach, clear evidence might have been adduced which would have satisfied the jury that the deceased had died from narcotic poison. In upposing that the deceased took a fatal does of an opiate, it was assumed that he had disposed of the bottle by throwing it out of the library-window, which was found open after the shutters had been fastened: no traces of the *com-posing draught* which he had told his servant he should take were found—not even the phial—and the coloured wrappers of paper, cork, and string found in the bedroom were not accounted for.

The only point that went against the presumption of narcotic poisoning was this: the servant swore on the trial that his master's bell rang about nine o'clock. If this were true, the deceased could not then have been under the influence of a narcotic poison, as he must have walked across the room to have rung the bell. This would have given but *three hours* for the fatal operation of the poison, while most cases of poisoning by opium have not proved fatal in less than from six to twelve hours. Still, opium has been known to cause death within a short period. Dr. Christison met with a case where the person died in three hours, and Dr. Beck another where death occurred in two hours and a half. But on comparing the evidence of this witness at the inquest and the trial there was a great discrepancy. He said nothing of a bell ringing when examined at the inquest recently after his master's death (*i. e.* two years before the trial), when it might be supposed that the whole of the circumstances were fresh in his mind. He had also stated that just before the alleged ringing of the bell, when he knocked at his master's door, on going up to his room about nine o'clock, he received no answer. There was only one bell in the house, and the four workmen employed about the house did not hear it ring during the whole of the morning. These four witnesses also deposed to another important fact: they swore that between eleven and twelve, hearing a groaning or a snoring in the deceased's bedroom, they proposed to the servant to break open the door and enter; but he objected because, he said, his master was poorly—that he had taken a composing draught, and had desired him not to go near the room until he heard his bell ring. This he said two hours after the time at which he swore on the trial that he had heard the bell ring and went up to answer it! This part of the evidence, which appeared to militate against the presumption of narcotic poisoning, was therefore inconsistent and unworthy of belief; but by a strange omission the discrepancies in the evidence of this witness escaped notice at the time. This case shows the importance, nay the absolute necessity, of performing post-mortem inspections and chemical analyses for inquests in a careful and proper manner. It also illustrates the principle that, although suicide may be a ground for vitiating a contract of this description, the allegation must not rest upon mere medical presumptions or inferences, but upon direct and positive proofs.

Among the medico-legal questions connected with this subject is the following: Does the proviso in the policy respecting suicide include all acts of self-destruction, or is it restricted only to those cases in which either a sane or a partially insane person consciously destroys himself? This question has been elsewhere considered (p. 1040). The act of suicide does not necessarily indicate insanity; but even if it did, the rule of law, as settled by a majority of the judges in reference to this proviso in cases of life-insurance, is that whenever an insured person destroys himself *intentionally*, whatever may be the state of his mind, the policy is void. If a person, whether sane or insane, kills himself *unintentionally*, then the insurers are liable; but the onus of proof in this case lies upon the plaintiffs, *i. e.* those who would benefit by the policy. According to the practice of some Offices, the act of suicide does not render a policy void.

It is naturally supposed that a man has a direct interest in preserving his own life, but this of course will not prevent him from falling a victim to the criminal designs of another. The insurable interest of a person in the life of another became an important question in January 1863, in *Hebdon* v. *West*. The plaintiff, a clerk in a banking-firm, had effected an insurance on the life of one Pedder, who was a member of the firm. Plaintiff became indebted to the firm for a sum of 5,000*l.*, and Pedder having informed the plaintiff that he should not be troubled with any demand for repayment during his (Pedder's) life, the plaintiff insured Pedder's life in the defendant's Company for the sum of 2,500*l.* It was the payment of this sum to the plaintiff that was now in dispute, the defendant contending that plaintiff had no insurable interest in the life of Pedder. The case was argued, and the Court put to counsel the cases which had been already decided, of a father insuring his own life or a husband his wife's. It had been held that in these cases there was no insurable interest. Hence, when a husband desired to make a provision for his wife, he insured his own life—she did not insure his. Further, they instanced the remarkable case of *Wainwright* (p. 1163), in which that person induced his sister-in-law to insure her life, and then poisoned her, in order, as next of kin, to get hold of the sum assured. That case showed the immense importance of the law requiring a real interest in the life of a person whose life was insured. The result of the argument was that the Court reserved its judgment; but there appeared to be no agreement concerning what was a legal insurable interest in the life of another.

The insurance of lives has been considered to be objectionable, on the ground that it tends to create an interest in the death of another, and thus to lead to secret acts of murder. The 14th George III. c. 48, expressly enacts that no insurance on life shall be valid unless the person insuring has a direct legitimate interest in the person whose life is insured. This statute was enacted for the purpose of preventing gambling in policies, and to guard society against the risk of persons insuring contriving the death of the insured for the sake of the payments to be made under the policy; but its effect is simply to render the policy void; it does not require that the premiums shall be refunded, nor does it award any penalty on the offenders. As policies of life-insurance may be bought and sold like other property, they may fall into the hands of persons who have no other interest in them than the desire that such policies should speedily become claims by the death of the insured. The interest of such holders, it has been justly observed, lies in the *death* and not in the *life* of the insured.

At p. 573 (*ante*) a case is related in which a man was found dead at St. Fergus, in Scotland, from a pistol-shot wound under very suspicious circumstances. The medical and moral facts were not consistent with the theory of suicide; on the contrary, they all pointed to a cool and deliberate act of murder. A medical man was placed on his trial for this alleged crime, and the motive assigned for the act was that the prisoner had recently effected insurances in three different Offices to the amount of about 2,000*l.*, upon the life of the deceased—a poor man, in whose life it was proved he could have had no lawful pecuniary interest. The insurances were only for short periods, and as in the Scotch Offices the policies are not rendered void by suicide, the amounts could be claimed even assuming that the deceased had destroyed himself. The body, weapon, and other objects had, it was supposed, been arranged with a view to make it appear that the act was suicidal. It is a significant fact however, as a key to explain the death of the deceased and the motive of the accused, that the risk connected with the largest insurance (1,000*l.*) commenced on the 24th November, 1852, and rminated on the 24th November, 1853. Only one premium to the amount f about eleven pounds had been paid, and this payment was proved to have een made by the prisoner. The deceased was found dead on the 20th Novem-er, 1853; *i. e.* only four days before the date at which the policy of insurance n his life would have lapsed. The evidence went to show that the accused ad the motive, means, and opportunity of committing this crime; but as there ere no circumstances which could directly fix it upon him, he was acquitted f the charge.

A remarkable case was tried in this country in 1835 (*Wainwright* v. *Bland*, xchequer, 29th June 1835), in which the amount of a policy of insurance ffected for two years on the life of a *Miss Abercromby* was sought to be ecovered. The action was brought against the Directors of the Imperial ssurance Company, and was resisted by them on the grounds that the lady ad been destroyed by poison, and that the plaintiff Wainwright had no lawful ecuniary interest in her life. As there is strong reason to believe that this as one of the first murders brought about by the use of strychnia in this ountry, it may be considered as the type of those which twenty-one years fterwards were for a time successfully perpetrated by the criminal William almer. Strychnia had been discovered only twelve years previously, nd it was then but little known as a poison either in England or France. The history of the case is remarkable, as the real cause of death was ompletely overlooked. Two fine-looking young women of the name of Abercromby, the daughters of a deceased officer, with no other property han pensions of ten pounds a year from Government, lived a few miles out f town with a man of the name of *Wainwright* and his wife, who were lso in reduced circumstances. They came to London in 1830, as the winter was setting in, and took lodgings. The elder girl, having just at-ained her twenty-first year, was sent, sometimes alone and sometimes with her sister, to no fewer than eight or ten Insurance Offices, to effect insurances at each on her own life. Being in full and vigorous health, she met with a favourable reception from several Offices, although she could assign no other reason for wishing to insure her life than that she was told it was right for her to do so. Five Offices granted policies in her own name, some for two, others for three years, for no less a sum than 16,000*l*. Among them the Imperial, in October 1830, accepted an insurance on her life for two years for 3,000*l*. On the 13th of the following December, when in perfectly good health, she made her will, and assigned this and other policies to the plaintiff Wainwright and his wife. On the evening of this day the whole party went to a public theatre, and on their return had a supper of oysters and porter. On this occasion Miss Abercromby was first taken ill; it was said she suffered from an hysterical attack, but there is no clear account of her illness at this time. It was not until the 16th that she was seen by a physician, but her illness was not such as to excite alarm; it was supposed to be hysterical. On the 21st this physician was suddenly called to see her, and he then found her in violent tetanic convulsions, resembling those which are sometimes the effects of a wound—i.e. *tetanus*. She said she was sure she should die, and she suddenly went off into a fit of convulsions. The physician left the house, returned in about an hour, and she was then just dead. The appearances presented by the body are imperfectly reported: there was an effusion of serum at the base of the brain, and to this death was referred. There was no analysis of the contents of the stomach: it is said they were minutely examined, and that there was no appearance of anything sufficient to account for death; but the person to whom this examination was entrusted was not called at the trial.

Wainwright, as executor and trustee, applied for payment of two of the policies which had been assigned to him, but this was refused. He then went to France with his family, and five years afterwards (in 1835), through an agent, brought an action against the Imperial Assurance Company. On this occasion the jury could not agree in a verdict. ('Med. Gaz.,' vol. 16, p. 606.) Another action was afterwards brought against the Company, and the facts above stated came out at the trial. The Attorney-General said that the plaintiff had left the country, and there was good reason to believe that he would never again return to it. The judge charged the jury that, whether murder had been committed or not, the executors could recover, provided the insurance had been effected *bonâ fide* on behalf of the deceased. His lordship directed their attention to the extraordinary fact of this young lady, the deceased, having effected these large insurances for only *two* years—of her sudden illness and death in convulsions soon after the assignment of the policy—and reminded them that no proof had been adduced to substantiate the reasons she had given to the various Offices for effecting the insurances on her life. By the will and assignment made to the plaintiff and his wife, these persons were placed in a situation in which the law would not allow any one to stand—namely, that of having a strong interest in procuring the death of a fellow-creature by unlawful means. The jury returned a verdict for the insurers, on the ground of misrepresentation and want of interest.

There can be no doubt that this young woman died from the effects of a dose of strychnia, administered to her shortly before she was seen by the physician on the afternoon of the 21st December. Tetanus as it is produced by this poison is rapidly fatal; but as it arises from wounds it comes on slowly, and is only fatal after some days, and there was no wound or other natural cause to account for its occurrence. Wainwright was subsequently tried, convicted of forgery, and transported. He died many years afterwards in one of our penal settlements, and before his death, it is reported that he substantially admitted that he destroyed Miss Abercromby and several other persons by strychnia.

Some of the poisonings which took place at Rugeley in 1855-6, and which culminated in the conviction and execution of the notorious *William Palmer* for the murder of J. P. Cook, originated in the easy system of raising money by the insurance of lives. The body of Ann Palmer, the wife of the prisoner, had been lying fifteen months in the grave, under a professional burial-certificate of death from *bilious cholera*, when the sudden death of Cook and the detection of antimony in his body led to the exhumation of the body of this lady. It was then found that she had died from the effects of antimony, which was detected by Dr. Rees and myself in all parts of the body, even in the ovaries. When the history of the illness which preceded death was gone into, it was found that the symptoms were consistent with the effects of tartarized antimony, but not with those of bilious cholera or any other disease. Antimony had not been prescribed for the deceased during her illness, and it was therefore clear that it must have been administered to her by some one up to within a short period of her death. With an actual life-interest in his wife's property to the extent of only 3,000*l.*, and within the short period of nine months of her death, *William Palmer* made, or caused to be made, proposals for insuring her life in eight different Offices for an aggregate sum of 33,000*l.* Three of these proposals, made by *himself*—to the Norwich Union in December 1853, for 3,000*l.*; to the Scottish Equitable in January 1854, for 5,000*l.*; and to the Sun in February 1854, also for 5,000*l.*—were accepted by these Offices. He thus contrived in less than three months to effect a total insurance of 13,000*l.*, to cover a life-interest of 3,000*l.* on his wife's property! The other proposals, to the amount of about 20,000*l.*, were declined by the Offices to which he applied. The total premiums paid by *Palmer* on the three policies amounted

388*l*.; and he was at the time so pressed for money, that he drew a bill hich was actually discounted on the security of the policies, so that he con-ived to make the policies pay for themselves. As he was in embarrassed rcumstances, and unable to meet bills of this kind without becoming *still* ore deeply involved in debt, the realization of the policies by the death of is wife became to him a matter of necessity. Within little more than six onths after effecting the insurances on her life, the wife died from poison nder his immediate superintendence. On her death these large sums were laimed by *Palmer*, and were paid to him by the Offices. Although there as at the time some suspicion that the wife had died from poison, there was o inquest or inspection, and the body was hastily buried. These facts nly came to light, more than a year afterwards, during the investigation of nother murder in 1855. It seems that the general respectability of *Palmer*, s social and professional position, together with the two medical certificates f the cause of the death of the wife, checked any intention which might have xisted on the part of the Offices to resist the payment of the policies. *Wil-iam Palmer*, however, carried his life-insurance speculations much further han this. Having no pecuniary interest whatever in the life of his brother Valter Palmer, he either made or induced him to make proposals for the in-urance of his life, in various Offices, to the amount of 82,000*l*. The Prince f Wales Office accepted the proposals to the extent of 13,000*l*., under certain imitations. On the 16th August, 1855, Walter Palmer died suddenly, in the resence of his brother and another man of doubtful character, with whom e had recently placed him as a lodger; and it was rendered highly robable, if not proved, that the prisoner *William* had shortly before pur-hased at a druggist's a bottle of prussic acid. The policy had been pre-iously assigned by Walter to *William*, for a nominal consideration: but when *William Palmer* made application for the amount after the death of his brother, the Office refused payment; and, for very good reasons, *Palmer* failed o enforce it. He subsequently tried, but ineffectually, to insure, to the xtent of 25,000*l*., the life of his groom, George Bates, described by him in his proposal as 'a gentleman' of independent means; and he advised a man named Cheshire, the Postmaster of Rugeley, also to make proposals on his life to the extent of 5,000*l*. and assign the policies to him. But for the revelation of facts connected with the death of Cook, these two persons, on whose heads a heavy life-insurance value had thus been set, would have been the next victims. Thuggism, as formerly perpetrated in India by a certain class of Hindoos, might be regarded as a venial offence compared with this professional mode of raising large sums of money upon human life.

It is now the custom of Offices to require a statement whether the life has been already proposed to other Offices, and whether the proposal has or has not been accepted. But this is only a partial method of checking such nefarious speculations. In France and most Continental States insurances of this kind are said to be strictly forbidden, not for the prevention of gambling (which is rather encouraged), but in order to guard society against the risk of the persons insuring contriving the death of the insured. That these regulations are not sufficient to guard against secret murder and speculation in human life is, however, clearly established by the case of *Dr. De la Pommerais*, who in May 1864 was convicted in Paris of the murder of a woman name Pauw. In another part of this work (p. 364) the reader will find an account of the medical circumstances connected with this act of murder, which equals, if it does not surpass in atrocity, the murders perpetrated by William Palmer on his wife and brother.

De la Pommerais had first cohabited with the deceased. Having thrown her off, he married, in August 1861, a lady of some fortune, Madlle. Dubizy.

Some time after the marriage, the mother of this lady died under very suspicious circumstances, as it was supposed, from poison administered by the prisoner. In June 1863 he suddenly and without any apparent cause renewed his intimacy with the deceased Pauw, who was living in great poverty with several of her children. Having advanced to her small sums of money, amounting on the whole to about 27*l.*, he induced her to insure her life in various Insurance Offices for the sum of 22,000*l.*, and afterwards to assign the policies to him. The reasons which he gave for effecting these insurances were—partly that he had advanced to the deceased large sums of money (4,000*l.*), and partly that, in the event of her death, he wished to provide for his illegitimate children. The first statement was proved to be untrue, and the second was inconsistent with the claims which he subsequently made on the Offices. The woman was examined, found to be in good health, and insurances on her life were effected for two or three years to the large amount above stated. La Pommerais paid the first premiums, amounting to 600*l.* He had thus entered into engagements for three years to pay in premiums a sum of about 800*l.* per annum, when his practice did not bring in more than 400*l.* per annum, and he had no other resources. He induced the deceased to feign that she was ill and had met with an accident; but the surgeons and physicians whom she consulted found, on examination, that there was nothing the matter with her, with the exception of a few attacks of vomiting. She continued well up to the 16th of November, when the prisoner visited her and passed the evening with her. She was taken very ill that night, and after violent vomiting and convulsions, with fainting, she died on the morning of the 17th, as it was proved, from the effects of digitaline, a large quantity of which the prisoner had purchased some time before, and of the disposal of which he could give no satisfactory account. He found no difficulty, however, in procuring a medical certificate to the effect that deceased had died from gastritis and perforation of the stomach. The policies of assurance had been assigned to him by the deceased shortly before her death, and it was the early claim which he put in for the payment of them that first led to suspicion. There was no answer to the charge of murder by the administration of digitaline, and the prisoner was convicted and executed.

The proper method to stop this secret system of murder would be by placing severe legal restrictions on the sale or assignment of policies, and by preventing the purchase of them by strangers, who can only have an interest in the death of the insured at the earliest possible period. The burial-club murders are said to have been much checked by a regulation which prohibited a person from recovering under this species of insurance more than the amount proved to have been actually paid for the funeral.

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